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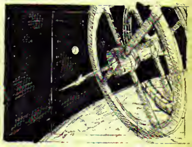
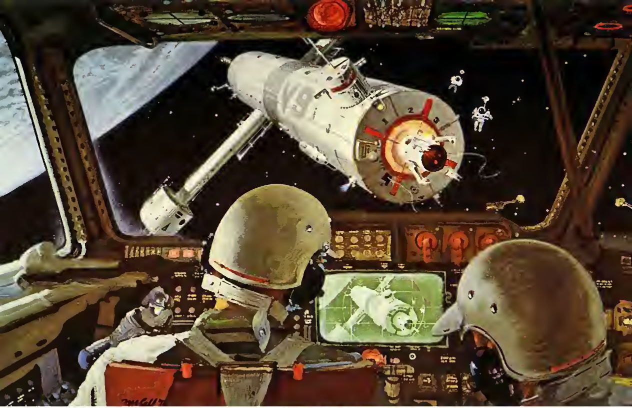
S-5

USAF
ATLAS

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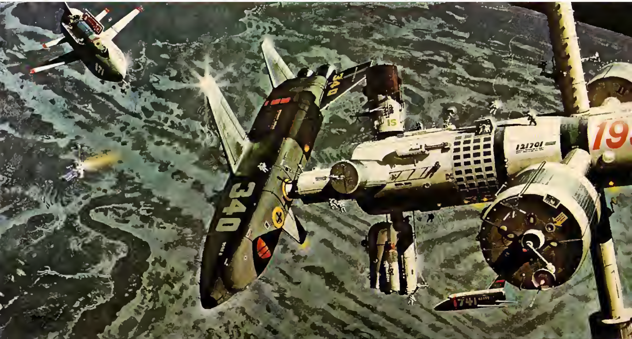
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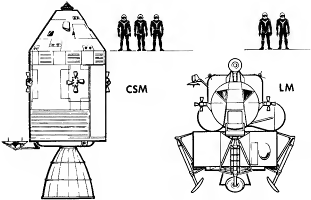
APOLLO CSM & LM COMPARISON



Artist's conception of rocket-driven XS1 zooming through stratosphere where clouds are ice crystals, meteors fall, and unending atmosphere where stars shine in daylight. Rocket's fire is yellow and white and thin trail of vapor lingers from wing tips.

The skin-tight high altitude suit which permits Army man to live normally as high as 200,000 feet above the earth

Going up . . . straight . . . 202,000 feet!

This amazing bit of "greased lightning" you see may literally carry its pilot out of this world. That is, the parts of this world that man has inhabited thus far. In fact, it is expected to journey into the upper stratosphere, some 200,000 feet above the earth where there isn't sufficient atmospheric pressure to sustain life.

The plane itself is remarkable, for it is propelled by rockets built to drive it at speeds as high as 1700 miles an hour up to 138,000 feet. Then, sheer momentum may enable it to coast on up to 202,000 feet!

Almost as remarkable as the plane is the suit which the pilot wears to keep him alive at these incredible altitudes. A great deal of scientific research has gone into its making to permit flexibility and compensate for the lack of pressure in the stratosphere. Oxygen is fed through a pressure helmet.

Both plane and suit are the results of experiments and developments of the U. S. Army Air Forces working hand in hand with civilian science and industry. They will permit studies hitherto impossible in the upper atmosphere — studies which may prove of enormous value to mankind.

Throughout the Army Air Forces and the whole new Regular Army, there are countless similar research projects under way this very minute. Every field of science is being explored to assure utmost protection for your nation.

To the individual who joins the Army, this research means training and experience he could not get anywhere else. He is given the opportunity to study and master skills which pave the way for a valuable career in the future. He may acquire technical knowledge not available to him outside the Army. His is a career to be envied.

Enlistments are open in the new Regular Army to young men 18 to 34 inclusive (17 with parents' consent). New higher pay, good food, clothing, quarters, medical and dental care, and many other advantages make the Army one of the most attractive openings to be found today. For full details, apply at your U. S. Army Recruiting Station.

Listen to "Sound Off," "Warriors of Peace," "Voice of the Army," "Proudly We Hail" on your radio

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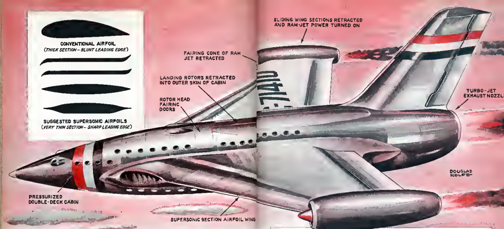
February 15, 1947

YOUR REGULAR ARMY SERVES THE NATION AND MANKIND IN WAR AND PEACE—CHOOSE THIS FINE PROFESSION NOW


CONVENTIONAL AIRFOIL
(THICK SECTION – BLUNT LEADING EDGE)
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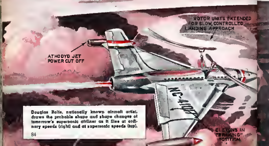
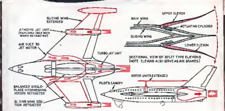
(VERY THIN SECTION – SHARP LEADING EDGE)
SLIDING WING SECTIONS RETRACTED AND RAM-JET POWER TURNED ON
FAIRING CONE OF RAM JET RETRACTED
LANDING ROTORS RETRACTED INTO OUTER SKIN OF CABIN
ROTOR HEAD FAIRING DOORS
TURBO-JET EXHAUST NOZZLE
PRESSURIZED DOUBLE-DECK CABIN
SUPERSONIC SECTION AIRFOIL WING
DOUGLAS ROLFE

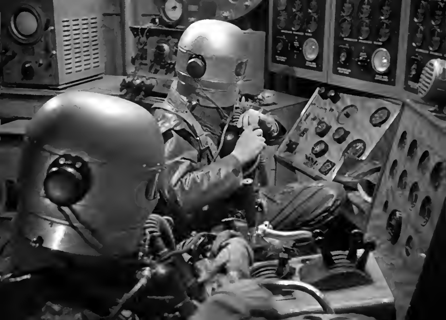

ROTOR UNITS EXTENDED FOR SLOW, CONTROLLED LANDING APPROACH
ATHODYD JET POWER CUT OFF
NC-4100
ELEVONS IN "BRAKING" POSITION

Douglas Rolfe, nationally known aircraft artist, draws the probable shape and shape changes of tomorrow's supersonic airliner as it flies at ordinary speeds (right) and at supersonic speeds (top).

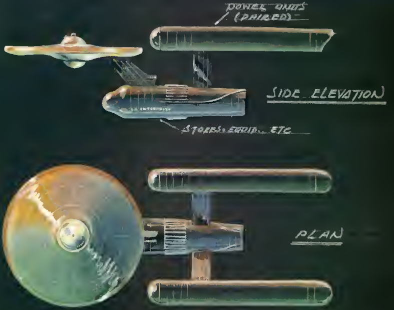

SLIDING WING EXTENDED
ATHODYD JET UNIT (EMPLOYED ONLY WITH WINGS RETRACTED)
AIR DUCT TO JET MOTOR
TURBO JET UNIT
BALANCED SINGLE-BLADE INTERMESHING ROTORS RETRACTED
SLIDING WING SECTION RETRACTED
MAIN WING
UPPER ELEVON
ACTUATING CYLINDER
SLIDING WING
LOWER ELEVON
SECTIONAL VIEW OF SPLIT TYPE ELEVONS
(NOTE ELEVONS ALSO SERVE AS AIR BRAKES)
ROTOR UNITS EXTENDED
PILOT'S CANOPY

Note in diagrams and drawings that at lower speeds the wing panels are extended, and the helicopter rotors and turbo-jet unit employed.

At supersonic speeds the wing panels are retracted, the rotors fit snugly inside the fuselage, and the athodyds or ram jets take over.



EMERGENCY
USE ONLY

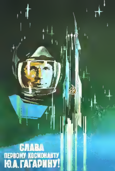

POWER UNITS
(PAIRED)
SIDE ELEVATION
ENTERPRISE
STORES, EQUIP., ETC
PLAN

ТЕХНИКА—МОЛОДЕЖИ

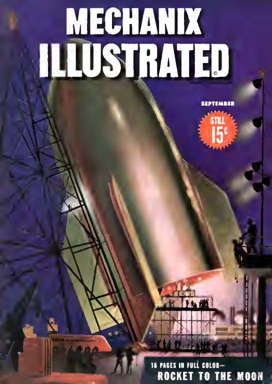
3

ТЕХНИКА-МОЛОДЕЖИ 12
1955
ЖУРНАЛ ЦК ВЛКСМ

ТЕХНИКА-
МОЛОДЕЖИ 8
1952
ЖУРНАЛ ЦК ВЛКСМ


СЛАВА
ПЕРВОМУ КОСМОНАВТУ
Ю.А. ГАГАРИНУ!

MECHANIX ILLUSTRATED



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adventure in space

SPACE PILOTS

by Willy Ley

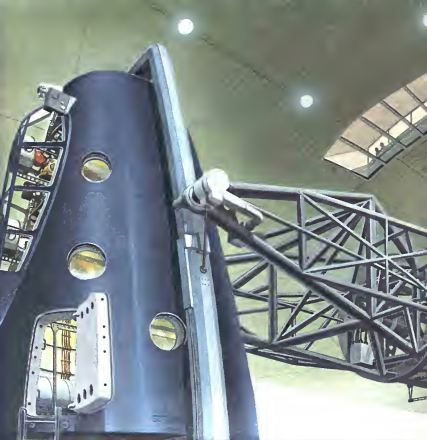
BOOK OF SPACE ADVENTURES

Landing on the moon...

BY SPACE SHIP TO THE MOON

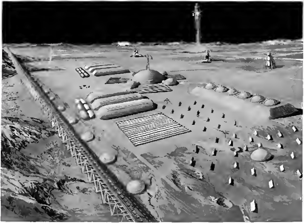
Jack Coggins and Fletcher Pratt

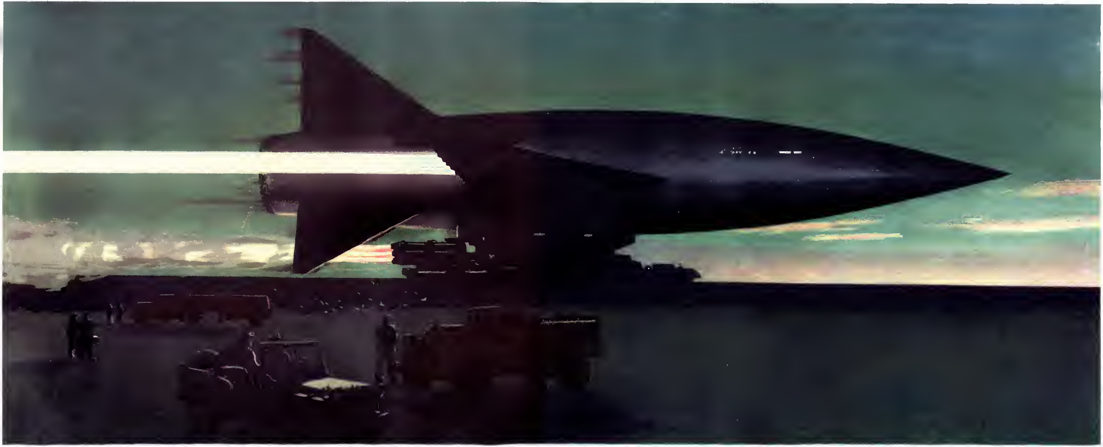
Foreword by WILLY LEY



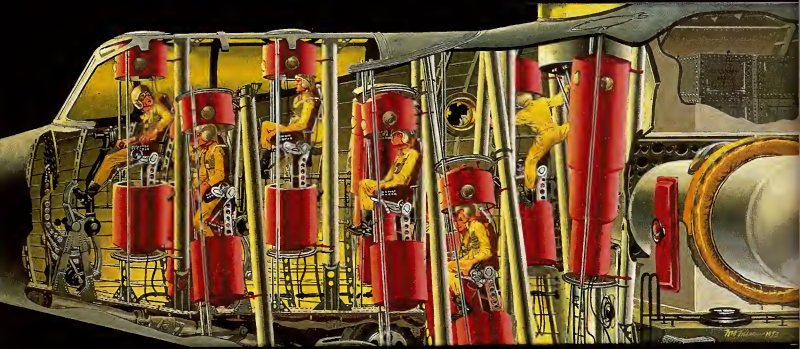
THE NEXT GREAT ADVENTURE

Written and illustrated by R. A. SMITH





The supply ship takes off. When sufficient speed is built up on launching track, jets will lift ship off rocket-propelled under-carriage. Then rocket motors will cut in.



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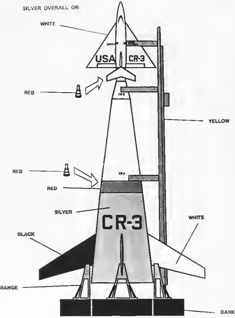
3-STAGE
FERRY ROCKET



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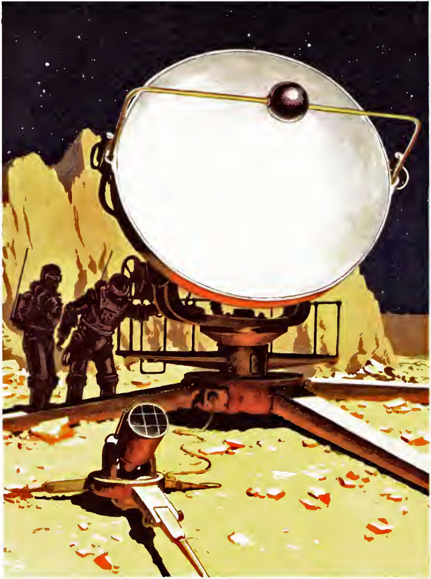
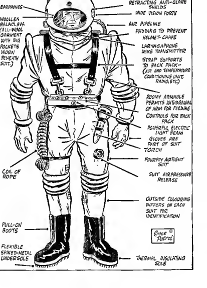
Crewless two-step orbital rocket roars up from desert launching site. Telemetering devices in nose section will send data back to earth.



Sun's rays are focused by large reflector on mercury boiler. Vapor will drive engines to furnish electric power.

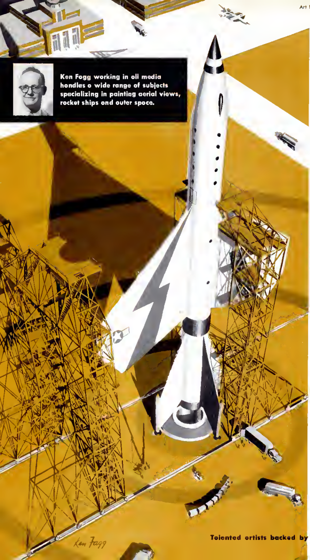
SPACE PATROL OFFICIAL SPACE SUIT


AERIAL
HELMET (DOUBLE-WALLS, VACCUUM SEPARATED.)
EARPHONES
RETRACTING ANTI-GLARE SHIELDS
WIDE VISION PORTS
WOOLLEN BALACLAVA (ALL-WOOL GARMENT WITH BIG POCKETS WORN BENEATH SUIT.)
AIR PIPELINE
PADDING TO PREVENT HELMET-CHAFE
LARYNGAPHONE MIKE TRANSMITTER
STRAP SUPPORTS TO BACK PACK- (AIR AND TEMPERATURE CONDITIONING UNIT, RADIO, ETC.)
ROOMY ARMHOLE PERMITS WITHDRAWAL OF ARM FOR FEEDING
CONTROLS FOR BACK PACK
POWERFUL ELECTRIC LIGHT BEAM
GLOVES ARE PART OF SUIT
TORCH
FOURPLY AIRTIGHT SUIT
COIL OF ROPE
SUIT AIRPRESSURE RELEASE
OUTSIDE COLOURING DIFFERS ON EACH SUIT FOR IDENTIFICATION
PULL-ON BOOTS
Space Patrol ®
FLEXIBLE SPIKED-METAL UNDERSOLE
THERMAL INSULATING SOLE

THE SYNDIC BY C.M. KORNBLUTH : MOB RULE IN USA

DECEMBER 1953 35c

160 PAGES!



Ken Fagg working in oil media handles a wide range of subjects specializing in painting aerial views, rocket ships and outer space.

Rolf Anderson
Gertrude Baehr
James Bama
Teasdale Barney
Sam J. Bates
Albert Baxter
Sheilah Beckett
Edward Berkovitz
Wayne Blickenstaff
Joe Bowler
Barbara Briggs
Lynn Buckham
Arthur T. Cooper
Charles E. Cooper
John Cornick
Donald Crowley
Bernard D'Andrea
John Del Gatto
Joe DeMers
Roy Deming
Anne Donovan
James Dwyer
Freeman Elliott
Kenneth Fagg
Lorraine Fox
Nino Giarratano
Mary Louise Gilkes
Remie Hamon
John Hickler
Fred Irvin
Alfred Jaeger
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William Kautz
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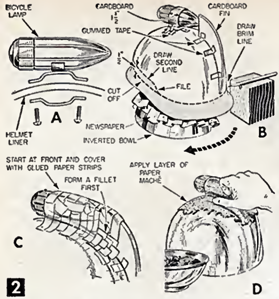
LET'S PRETEND

A Bonnie Book



2

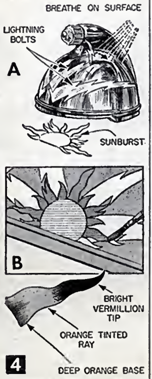
helmet as in Fig. 3B to permit the facepiece to fit against the sloping helmet, yet drop vertically to the shoulder.

Clear Plastic Facepiece. Use 0.010-in. thick acetate sheet, available from local art supply stores, for the facepiece. Wrap it around the helmet (Fig. 3C) and trim to length, allowing ½-in. overlap in back. Tape ends together and use a china marking pencil to draw a line on the acetate along the top edge of the spacer strip. Cut along the line, then tape facepiece in place, matching top edges of the acetate and spacer strips.

Ground your astronaut long enough to try on the helmet and cut the neckpiece to fit at the shoulder line as in Fig. 3D. Check and trim as needed until the helmet fits snuggly over the shoulders, chest, and back with full weight borne by band inside helmet. Now remove facepiece and decorate helmet with household aluminum foil.

Alumium Foil Decorations. Trace shape of decorations (Fig. 7) on foil and cut out with scissors. If foil wrinkles when cut, press it onto a piece of waxed paper, cut, and remove. Lay ends of four lightning bolts in position (Fig. 4A) and breathe on area to be covered to soften enamel surface. Immediately press foil against the helmet and rub smooth. Apply center sunburst design over lightning bolts, gluing where foil overlays foil. Coat entire helmet, including decorations, with clear varnish. When dry, sand smooth with fine sandpaper, dust, and re-varnish.

Next place small dabs of yellow and vermilion oil colors at the side of a saucer or palette in the center of which have been mixed a tablespoonful of varnish and a couple of drops of boiled linseed oil. Do not use turpentine or allow turpentine to get into paint or on brushes. Thoroughly mix a little yellow into the varnish and brush this over sunburst design, trying not to overlap brush



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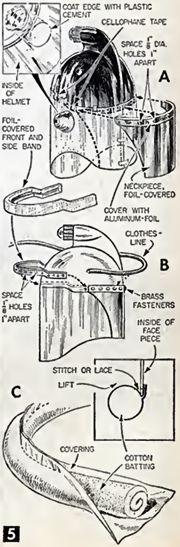

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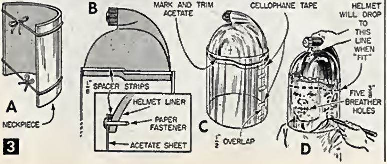


3

PEACE—OR ELSE!

BY WILLY LEY

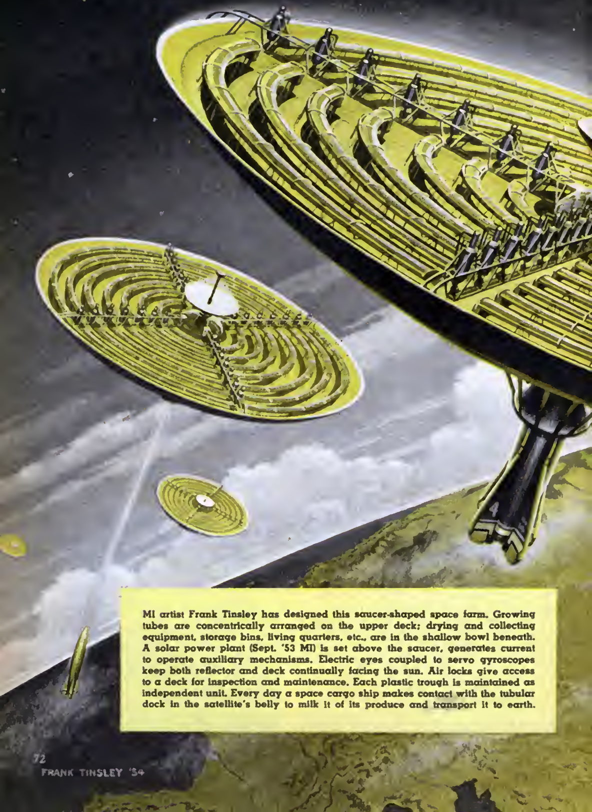
Radar and television controlled atom bombs, directed by distant ground pilots, could devastate New York. Radar interceptors would be countermeasure.

HUMANITY is faced with the greatest decision it has ever had to make. The atomic bomb, in three gigantic flashes, has transformed our planet into a world which has only one choice left. Earth has become a world of Either/Or.

Either—we are firmly determined that there shall be no war, and spend as much energy, thought and money on the problem of preventing it as we now spend in preparing for it. In that case—and if we

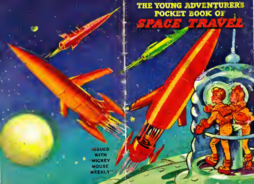
Should earth's food supply grow scarce, science will look to algal culture and . . .

Moon Farms

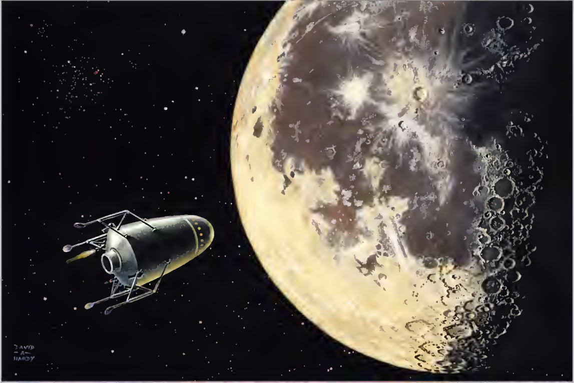


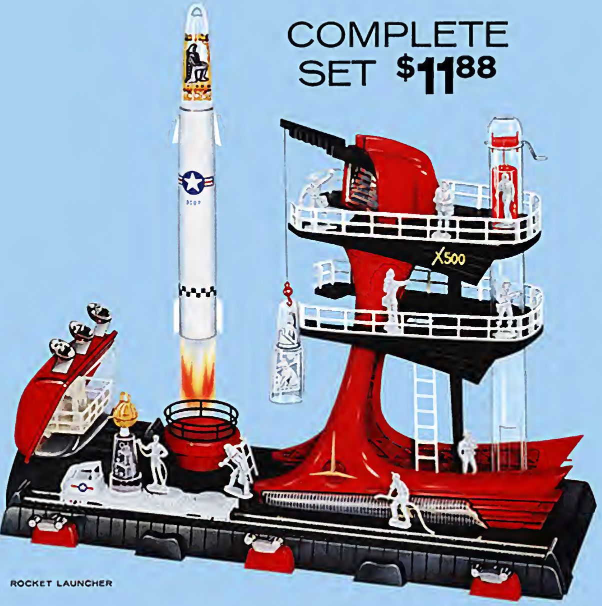
MI artist Frank Tinsley has designed this saucer-shaped space farm. Growing tubes are concentrically arranged on the upper deck; drying and collecting equipment, storage bins, living quarters, etc., are in the shallow bowl beneath. A solar power plant (Sept. '53 MI) is set above the saucer, generates current to operate auxiliary mechanisms. Electric eyes coupled to servo gyroscopes keep both reflector and deck continually facing the sun. Air locks give access to a deck for inspection and maintenance. Each plastic trough is maintained as independent unit. Every day a space cargo ship makes contact with the tubular dock in the satellite's belly to milk it of its produce and transport it to earth.

THE YOUNG ADVENTURER'S POCKET BOOK OF
SPACE TRAVEL



ISSUED WITH "MICKEY MOUSE WEEKLY"


DAVID A HARDY



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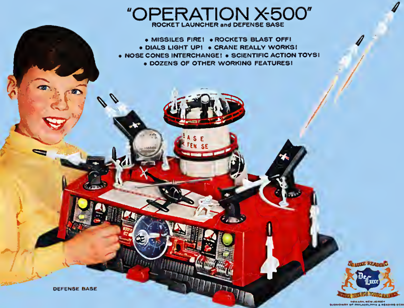

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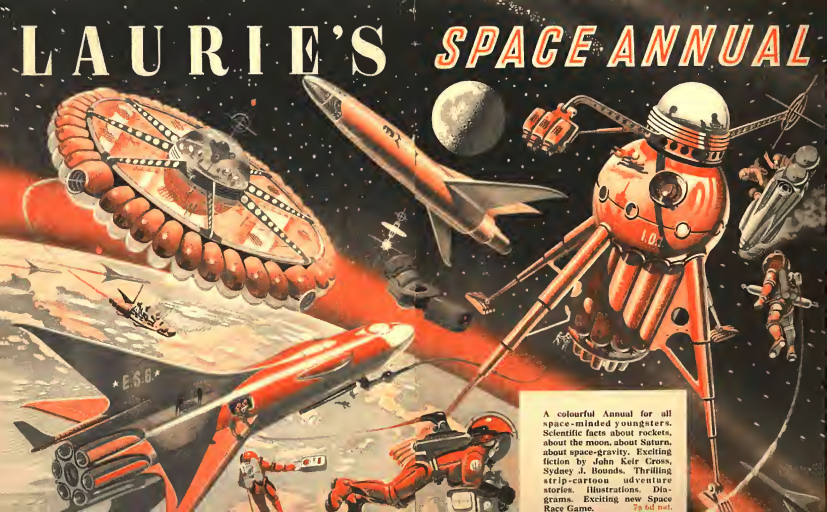
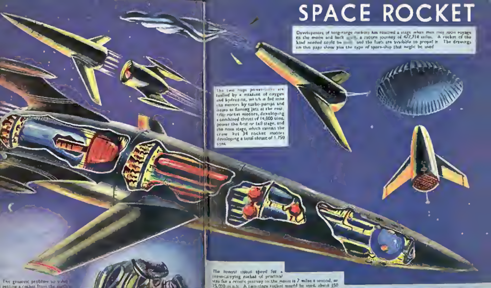
LAURIE'S SPACE ANNUAL



A colourful Annual for all space-minded youngsters. Scientific facts about rockets, about the moon, about Saturn, about space-gravity. Exciting fiction by John Keir Cross, Sydney J. Bounds. Thrilling strip-cartoon adventure stories. Illustrations. Diagrams. Exciting new Space Race Game. 7s 6d net.

SPACE ROCKET

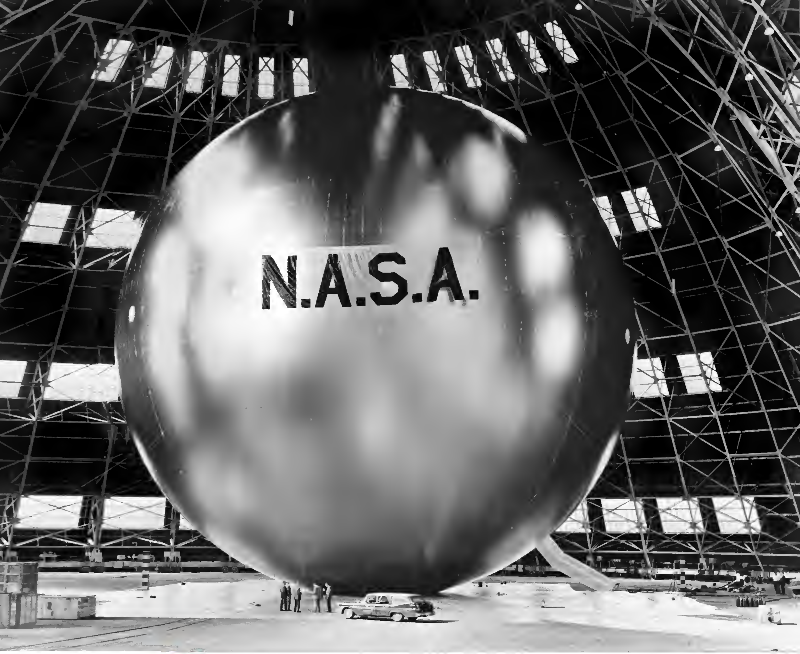
Development of long-range rockets has reached a stage when man may soon voyage to the moon and back again, a return journey of 477,714 miles. A rocket of the kind needed could be built and the fuels are available to propel it. The drawings on this page show you the type of space-ship that might be used.



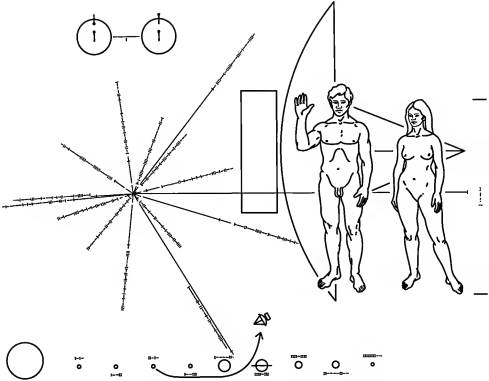
The two huge power-units are fuelled by a mixture of oxygen and hydrazine, which is fed into the motors by turbo-pumps and issues as flaming jets at the rear. The rocket motors, developing a combined thrust of 14,000 tons, power the first or tail stage, and the nose stage, which carries the crew, has 36 rocket motors developing a total thrust of 1,750 tons.

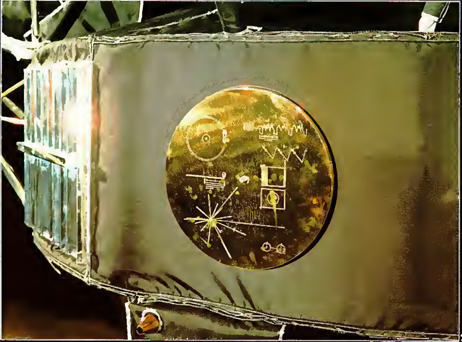
The greatest problem to solve
getting a rocket from the earth

The lowest initial speed for a crew-carrying rocket of practical size for a return journey to the moon is 7 miles a second, or 25,000 m.p.h. A two-stage rocket would be used, about 150

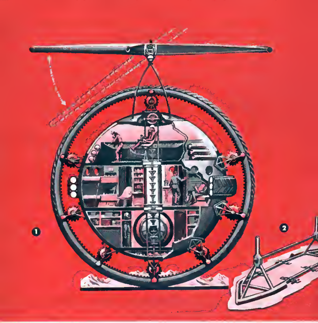


Static Inflation Test of 135 Ft Satellite In Weeksville, NC
NASA Langley Research Center 6/28/1961





NASA
66671
U.S. AIR FORCE



MOON EXPLORER diagram: 1. Sectional cutaway shows triple-deck arrangement, tilting power parasol, spare tire and drive-drum installations on the inner rim of the wheel. 2. Drive-drum mounting is made of welded, lightweight tubing. Simple latch fastenings secure it. All mountings are interchangeable and, disassembled, nest for easy transport.

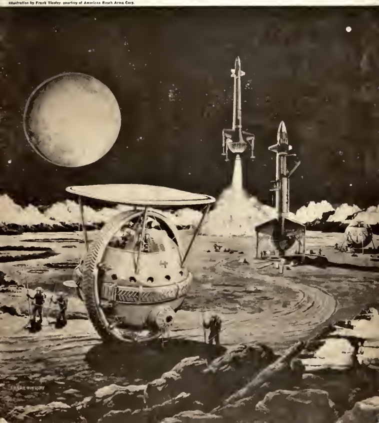
The Moon Explorer is 32 ft. high. It is driven by electric motors and stabilized and steered by gyroscopic tilting. Power is derived from a circular "parasol" faced with solar batteries that always face the sun. Those atop the disc are of the light-actuated type. The bottom units are thermal generators, extracting electricity from reflected ground heat. This arrangement uses every inch of area and constitutes a simple, long-lived generator with no moving parts. It not only produces free power but also serves to shield the vehicle's body from the burning rays of the unfiltered lunar sun. Despite its large size, the parasol is extremely light in weight. It consists of an envelope of thin, inflated fabric, stiffened by internal spokes and a rim of inflated tubing. It is carried above the wheel tread on four light magnesium legs and mounted

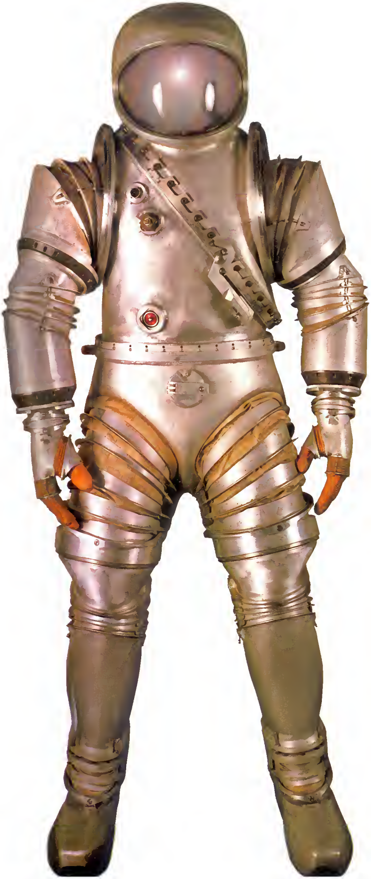
Junior Scholastic

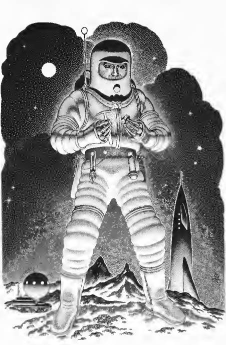
YOUR WORLD-VIEW MAGAZINE FOR SCHOOL AND HOME • VOLUME 49 • NUMBER 2 • SEPTEMBER 20, 1961

THE UNICYCLE—Will It Carry Men on the Moon? (see Science News, p. 7)

Illustration by Frank Tinsley courtesy of American Bosch Arma Corp.







Space suit

7

National Aeronautics and Space Administration

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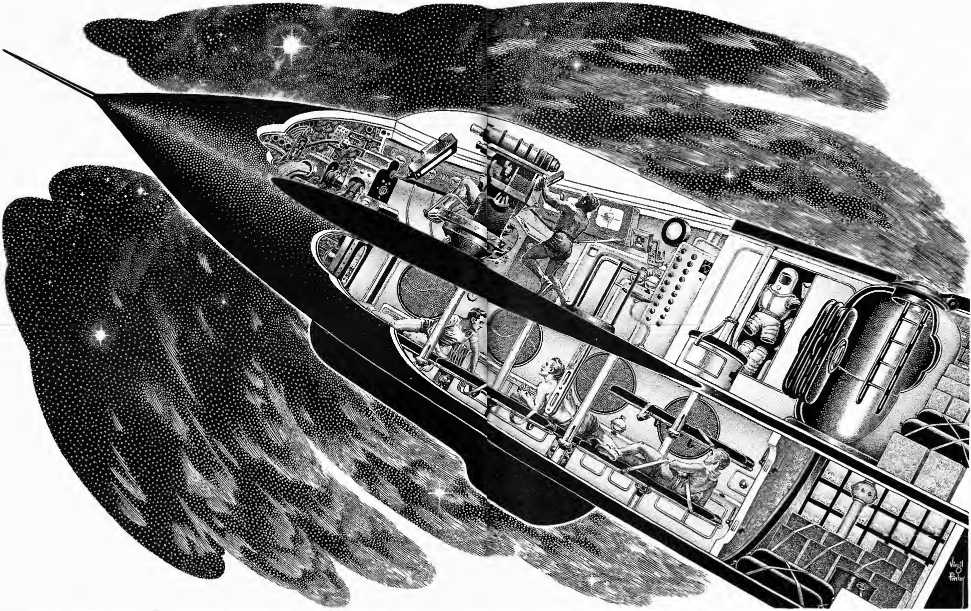
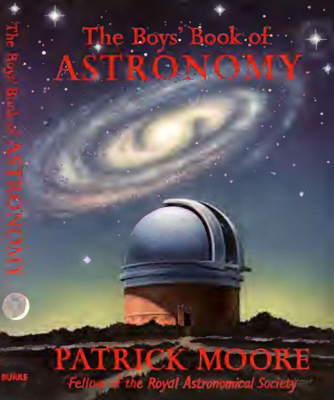


Cross section of first stage of rocket ship

The Boys' Book of ASTRONOMY



PATRICK MOORE

Fellow of the Royal Astronomical Society

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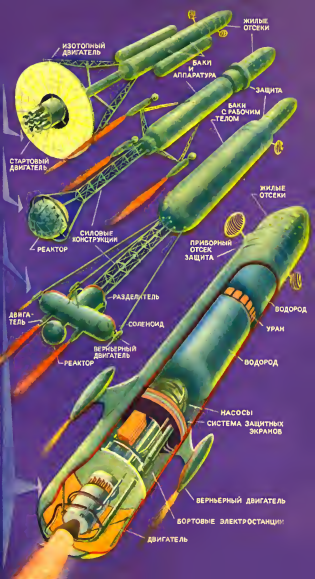
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СИСТЕМА ЗАЩИТНЫХ ЭКРАНОВ
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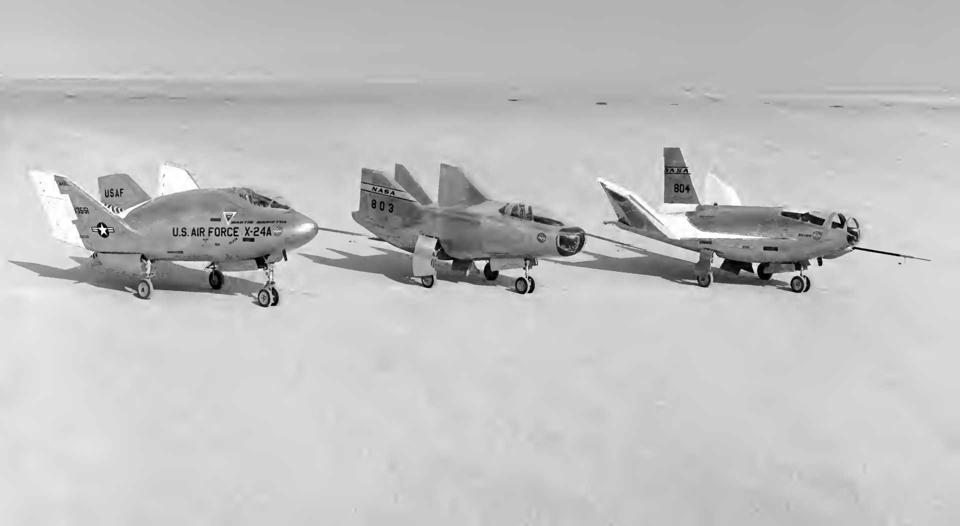
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47
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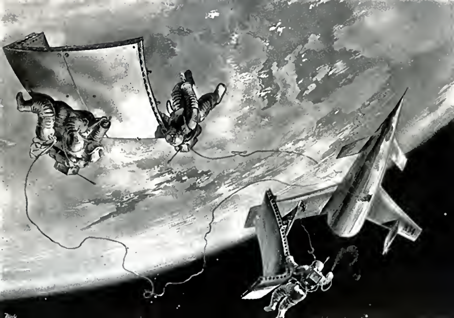

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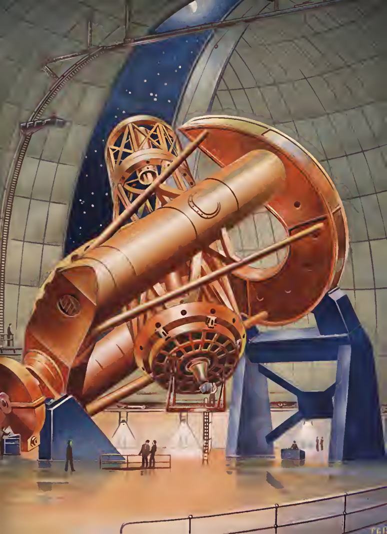
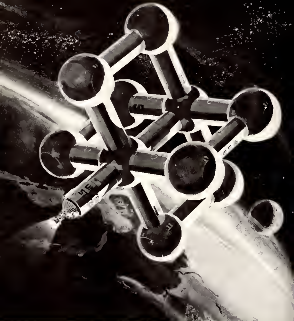
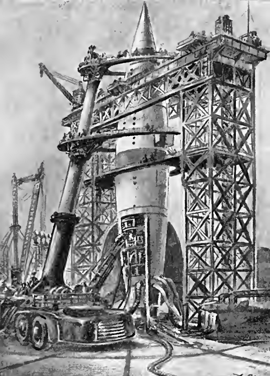
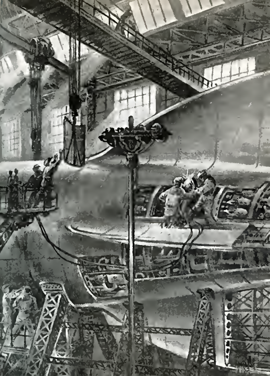


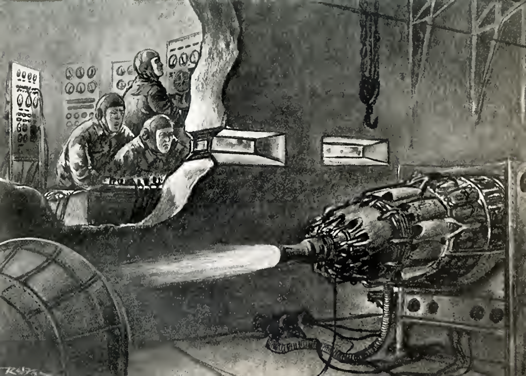


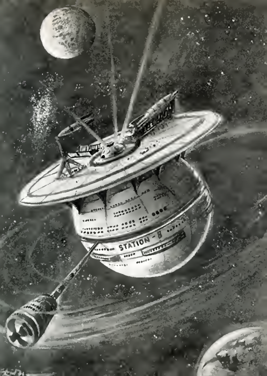
Douglas Air

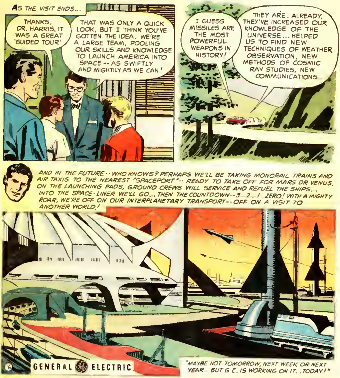
Its series of spheres and cylinders firmly bolted together, a Spaceball station is moved into its final earth orbit by rocket engine in one of the stages. Instead of the 2–8-man crews of MOL and other laboratories of the 1960s, Spaceball is manned by dozens of astronauts and scientists. If desired, such a station could also be powered out of earth orbit and into a trajectory to another planet.








STATION - 8


AS THE VISIT ENDS...
THANKS, DR. HARRIS. IT WAS A GREAT 'GUIDED TOUR'
THAT WAS ONLY A QUICK LOOK, BUT I THINK YOU'VE GOTTEN THE IDEA. WE'RE A LARGE TEAM, POOLING OUR SKILLS AND KNOWLEDGE TO LAUNCH AMERICA INTO SPACE -- AS SWIFTLY AND MIGHTILY AS WE CAN!
I GUESS MISSILES ARE THE MOST POWERFUL WEAPONS IN HISTORY!
THEY ARE. ALREADY, THEY'VE INCREASED OUR KNOWLEDGE OF THE UNIVERSE... HELPED US TO FIND NEW TECHNIQUES OF WEATHER OBSERVATION, NEW METHODS OF COSMIC RAY STUDIES, NEW COMMUNICATIONS
AND IN THE FUTURE -- WHO KNOWS? PERHAPS WE'LL BE TAKING MONORAIL TRAINS AND AIR TAXIS TO THE NEAREST "SPACEPORT" -- READY TO TAKE OFF FOR MARS OR VENUS. ON THE LAUNCHING PADS, GROUND CREWS WILL SERVICE AND REFUEL THE SHIPS.. INTO THE SPACE-LINER WE'LL GO... THEN THE COUNTDOWN -- 3 .. 2 .. 1 ZERO! WITH A MIGHTY ROAR, WE'RE OFF ON OUR INTERPLANETARY TRANSPORT -- OFF ON A VISIT TO ANOTHER WORLD!
16
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OUR PLACE IN SPACE

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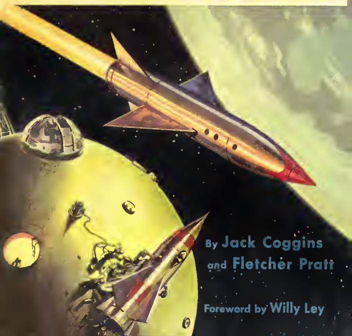

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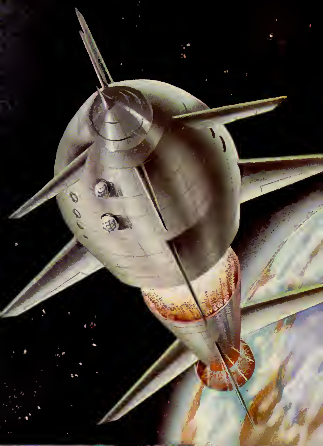
and Fletcher Pratt

Foreword by Willy Ley



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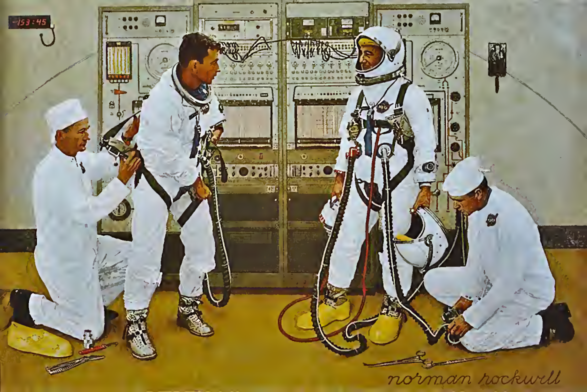
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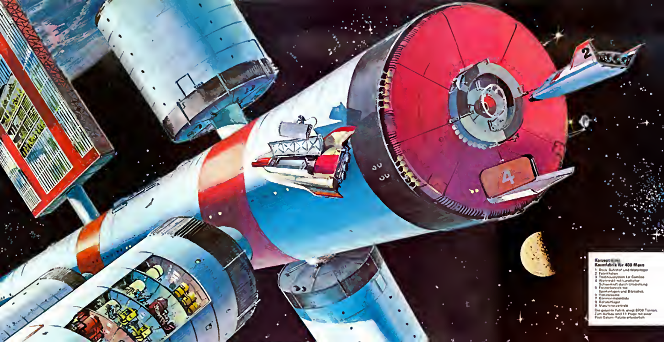
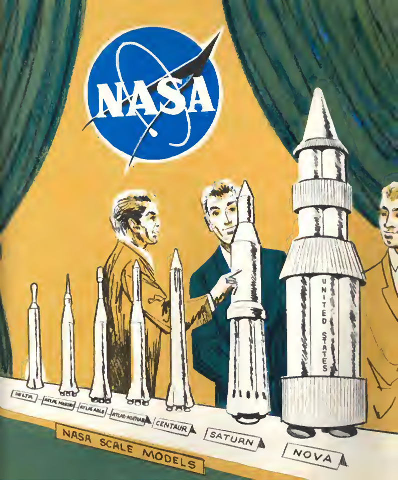


Konzept einer Raumfabrik für 400 Mann

1 Dock, Bahnhof und Warenlager
2 Fabrikhallen
3 Treibhaussystem für Gemüse
4 Wohntrakt mit künstlicher Schwerkraft durch Umdrehung
5 Freizeitbereich mit Sportanlagen und Bibliothek
6 Verwaltung
7 Kommandozentrale
8 Rohstofflager
9 Maschinenzentrale

Die gesamte Fabrik wiegt 8700 Tonnen. Zum Aufbau sind 11 Flüge mit einer Post-Saturn-Rakete erforderlich.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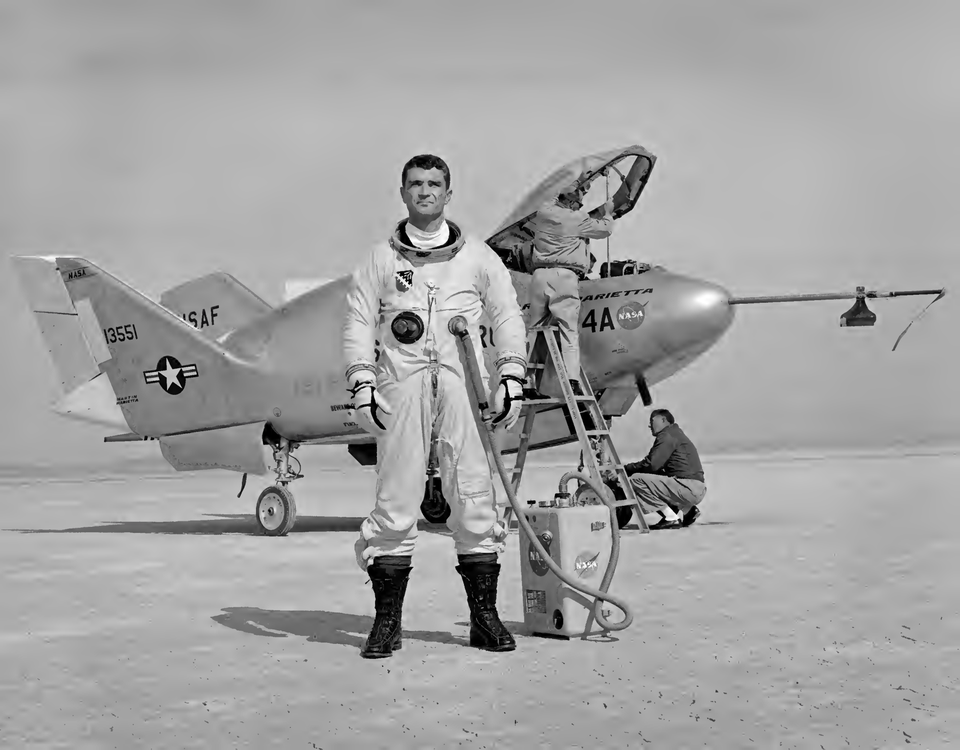
Televising a Lunar Landing (courtesy, U. S. Air Force)

Douglas Aircraft Corp.

Space delivery — The partnership of the space ferry and the manned orbital laboratory is demonstrated in this sketch. Here astronauts in a Douglas Astro ferry approach a huge space station with fresh supplies of food and test equipment. Eventually, experimental orbiting stations may give way to orbiting terminals for space travelers of the future.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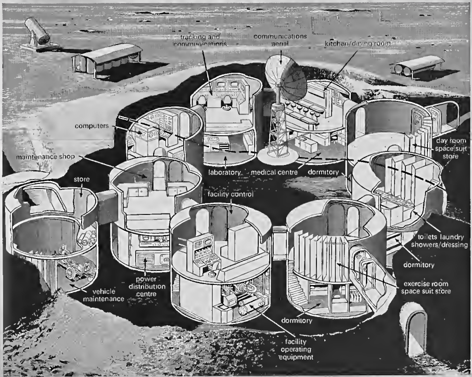
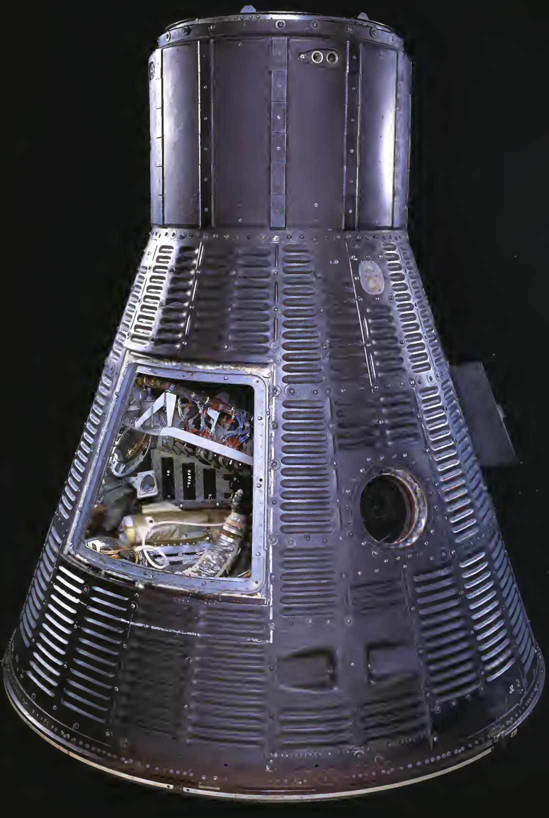
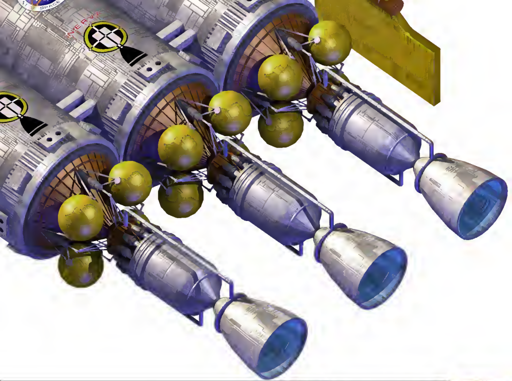

tracking and communications
communications aerial
kitchen/dining room
computers
day room
space suit store
maintenance shop
laboratory
medical centre
dormitory
store
facility control
toilets laundry
showers/dressing
dormitory
power distribution centre
vehicle maintenance
exercise room
space suit store
dormitory
facility operating equipment





Concept and blueprints: Paul Davies
Original "Botany Bay": Matt Jeffries Texture: Marc-Laurent Magnier
Mesh: Winchell Chung
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SPECIAL RECORDING: "SOUNDS OF THE SPACE AGE" (page 750)

VOL. 136, NO. 6
DECEMBER 1969

NATIONAL GEOGRAPHIC

FIRST EXPLORERS ON THE MOON

THE INCREDIBLE STORY OF APOLLO 11 IN FIVE PARTS [illegible]

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IRVING AND ELECTA JOHNSON
JOSEPH J. SCHERSCHEL

INSIDE A HORNBILL'S WALLED-UP NEST [illegible]
JOAN AND ALAN ROOT

CHARTRES, LOVELY LEGACY OF THE AGE OF FAITH [illegible]
KENNETH MacLEISH
[illegible]

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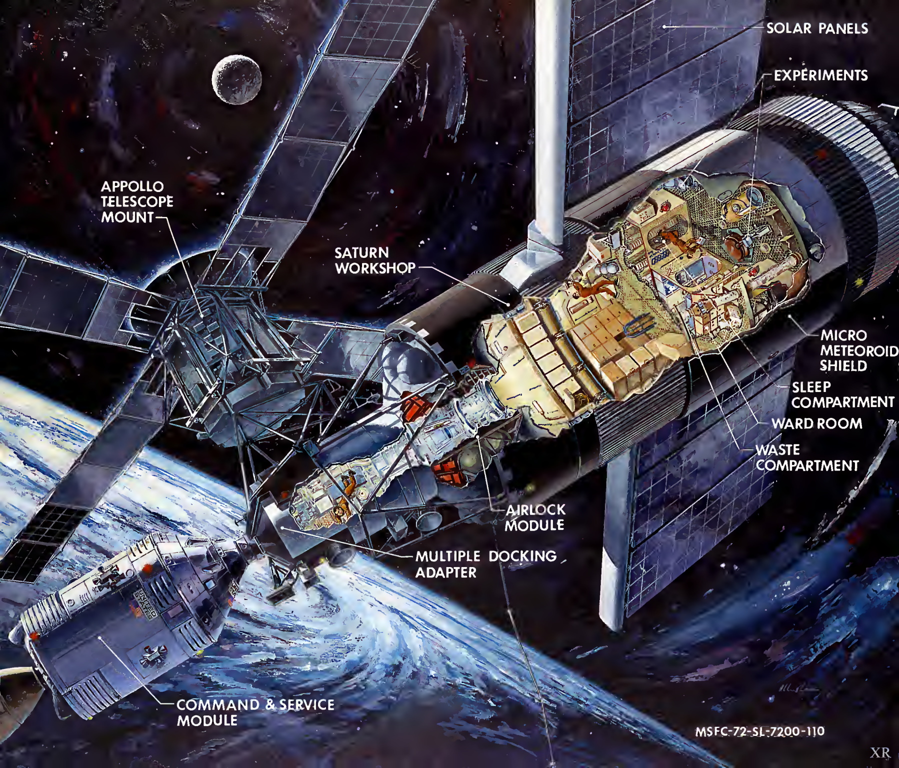
OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON D C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NASA

Toward the preparation of man for the first steps into deep space, the Martin space medicine research program and space ecology laboratory facilities—now in development at the Denver Division—are among the most advanced activities in the free world. Especially noteworthy is the Martin Lunar Housing Simulator. This will be a self-sustaining environmental closed system which will permit advanced study of survival requirements and techniques applicable to airless lunar or planetary conditions.

THE FIRST STEP

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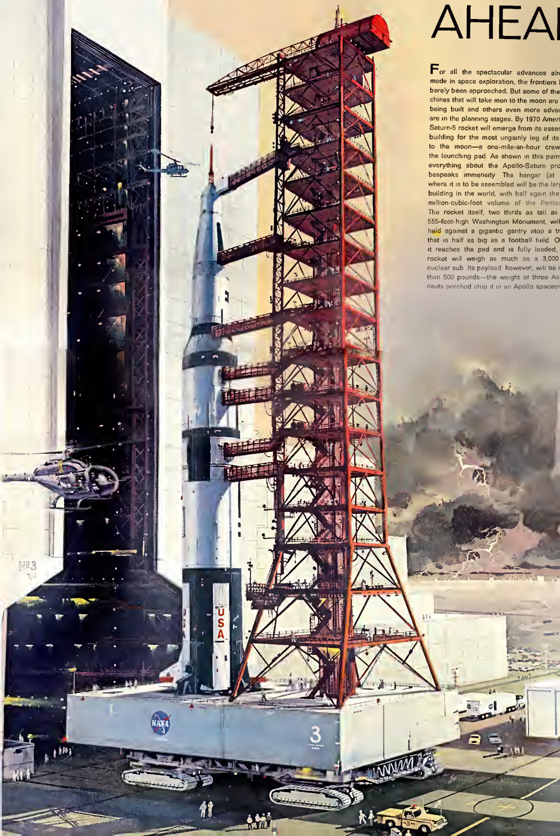
SPACE/Part 2

Visions of a wondrous technology

WHAT LOOMS AHEA

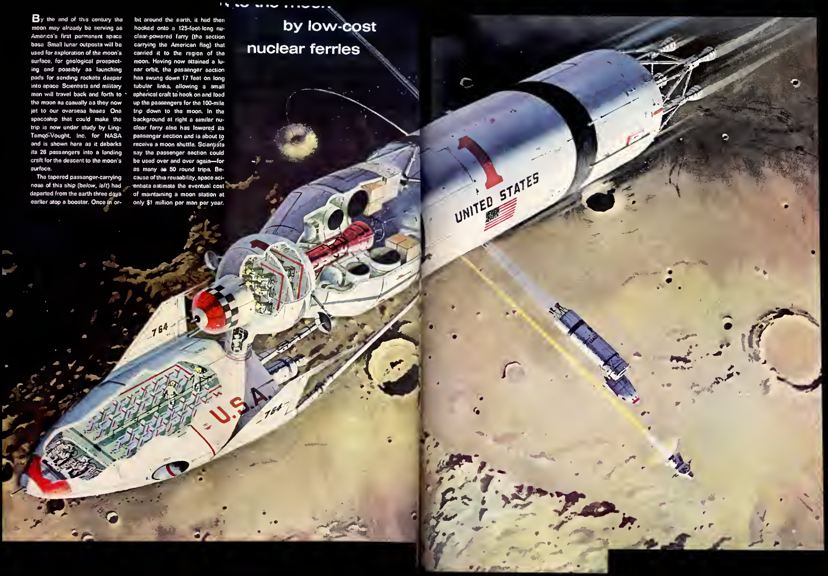
For all the spectacular advances alr
made in space exploration, the frontiers
barely been approached. But some of the
chines that will take men to the moon are
being built and others even more adva
are in the planning stages. By 1970 Amer
Saturn-5 rocket will emerge from its asse
building for the most ungainly leg of its
to the moon—a one-mile-an-hour craw
the launching pad. As shown in this pain
everything about the Apollo-Saturn pr
bespeaks immensity. The hangar (at
where it is to be assembled will be the lar
building in the world, with half again the
million-cubic-foot volume of the Penta
The rocket itself, two thirds as tall as
555-foot-high Washington Monument, wil
held against a gigantic gantry atop a t
that is half as big as a football field. O
it reaches the pad and is fully loaded,
rocket will weigh as much as a 3,000-
nuclear sub. Its payload, however, will be
than 500 pounds—the weight of three As
nauts perched atop it in an Apollo spacec

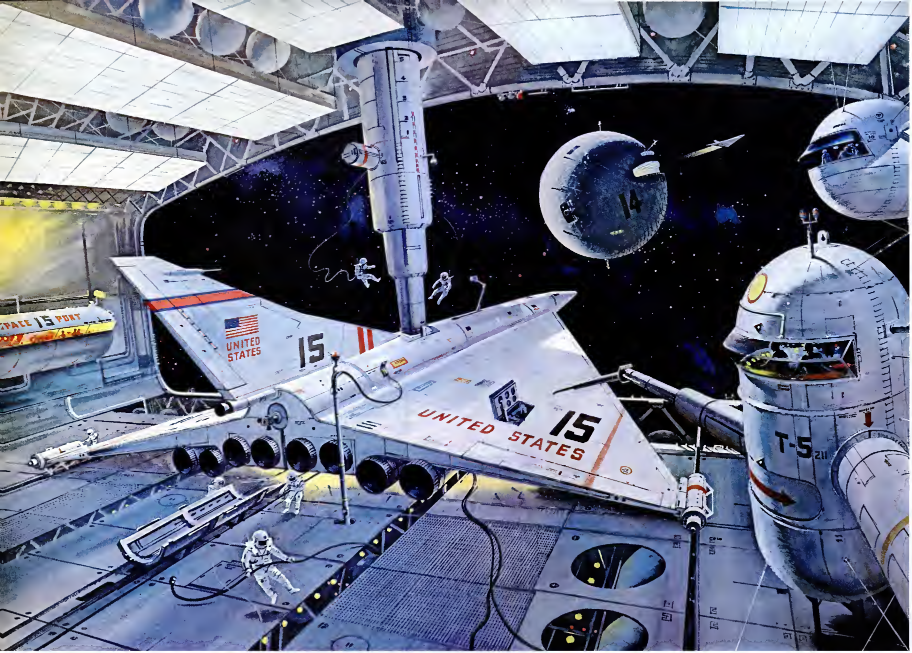


by low-cost nuclear ferries

By the end of this century the moon may already be serving as America's first permanent space base. Small lunar outposts will be used for exploration of the moon's surface, for geological prospecting and possibly as launching pads for sending rockets deeper into space. Scientists and military men will travel back and forth to the moon as casually as they now jet to our overseas bases. One spaceship that could make the trip is now under study by Ling-Temco-Vought, Inc. for NASA and is shown here as it debarks its 28 passengers into a landing craft for the descent to the moon's surface.

The tapered passenger-carrying nose of this ship (*below, left*) had departed from the earth three days earlier atop a booster. Once in orbit around the earth, it had then hooked onto a 125-foot-long nuclear-powered ferry (the section carrying the American flag) that carried it to the region of the moon. Having now attained a lunar orbit, the passenger section has swung down 17 feet on long tubular links, allowing a small spherical craft to hook on and load up the passengers for the 100-mile trip down to the moon. In the background at right a similar nuclear ferry also has lowered its passenger section and is about to receive a moon shuttle. Scientists say the passenger section could be used over and over again—for as many as 50 round trips. Because of this reusability, space scientists estimate the eventual cost of maintaining a moon station at only $1 million per man per year.





Way-station for men bound for the planets

Just as the air age created the need for air terminals, the age of space travel will require the establishment of manned space stations, and thought is already being given to possible designs. In four decades, space stations—possibly like those shown here—may be in orbit around the earth and serving a variety of purposes. They could be used as weather stations, astronomical observatories, supply points for military space bases, data collection centers for unmanned satellites, even as centers of medical research to investigate the effect of weightlessness on disease. Diplomats reluctant to meet on each other's home ground could travel within minutes to neutral man-made terrain high above the earth and its discords.

But the space station's most practical and perhaps most valuable function will be as a launch platform for interplanetary spacecraft. A hydrogen-fueled shuttle ship like the one seen here could rocket up from the earth, back into the station's hangar and discharge passengers through a telescoping airlock into an overhead waiting room. Men in space suits would swarm around like a ground crew while the vehicle loads up from a fueling tower (*right, foreground*) and the passengers wait for the connecting flight to Mars.

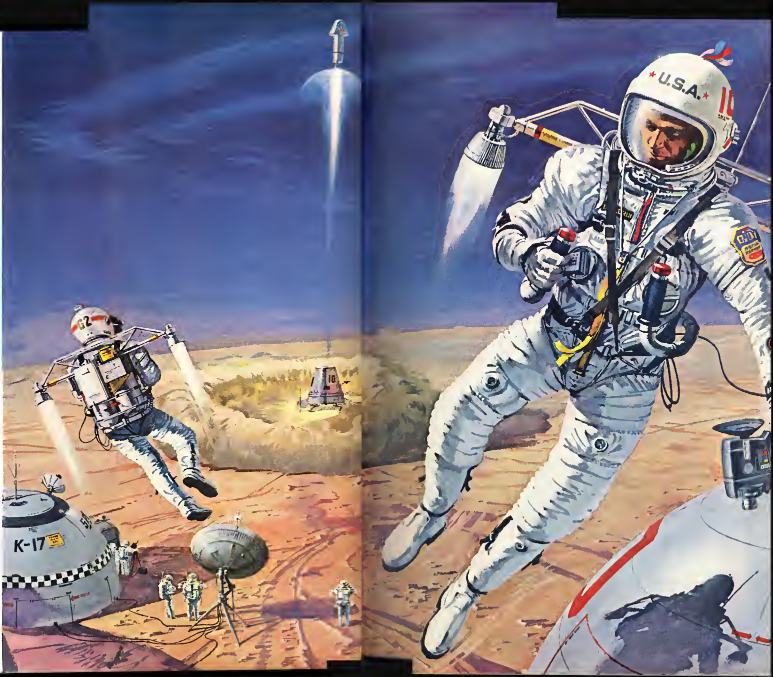
Exploring on Mars, half a year from home

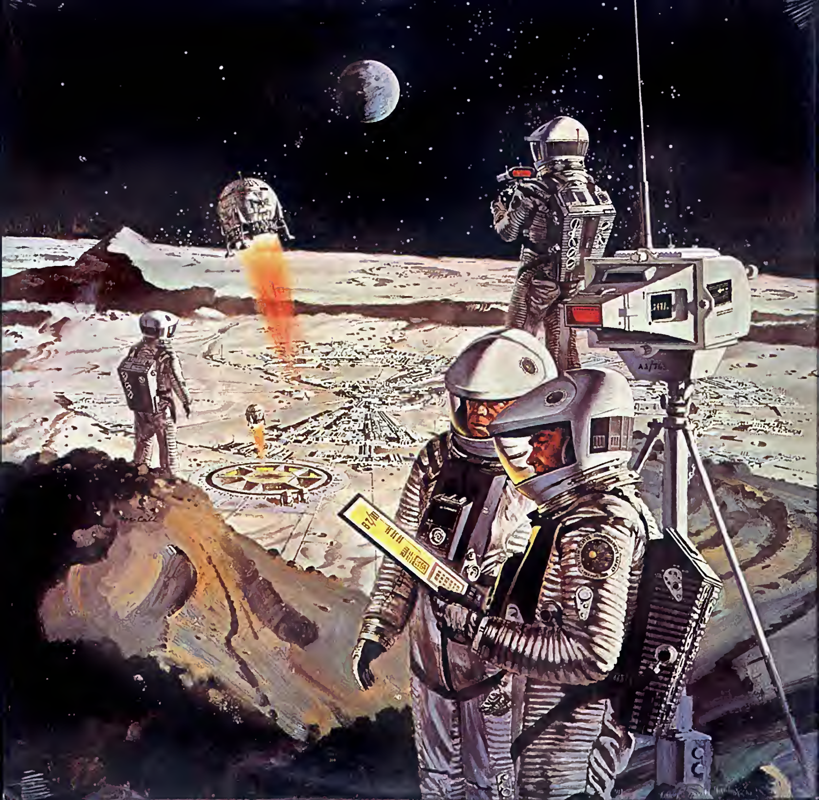
Within the next few weeks NASA plans to launch two photoreconnaissance vehicles on a trajectory that will take them close to Mars eight months later. Hopefully they will send back data indicating that a manned flight to the planet would be feasible, perhaps within the next two decades.

When and if men do attempt the trip, they may aim for the edge of one of the vast flat desert areas believed to exist on Mars. In this painting the Astronauts—wearing suits designed for a landing on the moon—have established a Mars base camp. They have set up inflatable igloo-shaped shelters (*lower left and right*) with materials brought in their capsule, and they communicate with earth on radio waves beamed from parabolic antennas. Gas jets strapped to their backs help them get around.

When it is time to leave, the three-man teams will climb back into their arrival vehicle and fire themselves into a Mars orbit where they will rendezvous with a parent ship for the six-month journey back to earth.

Most scientists believe that if life exists on Mars, it is very primitive, perhaps a kind of lichen-like plant. But no one rules out the possibility of surprises. A study made for NASA of possible Mars landing systems by Philco's Aeronutronic Division touches on that possibility. "In the event higher animal forms are encountered, it will be desirable to trap living specimens. They will probably tend to be elusive, however, and photographs or casts of surface imprints may have to suffice."





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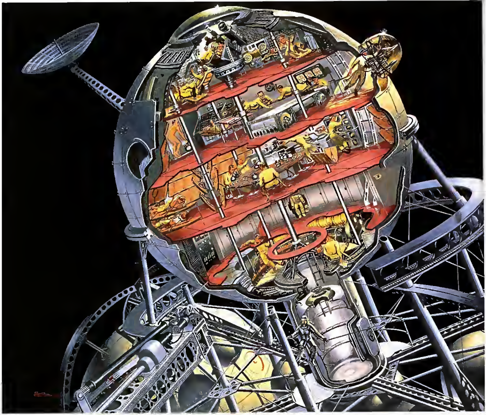

The moonships' passenger spheres consist of an upper control deck and, directly below, the navigation deck. The largest deck accommodates the living quarters. Below it is the stowage deck and at the very bottom, the engineering deck. (Fred Freeman)

LIFE

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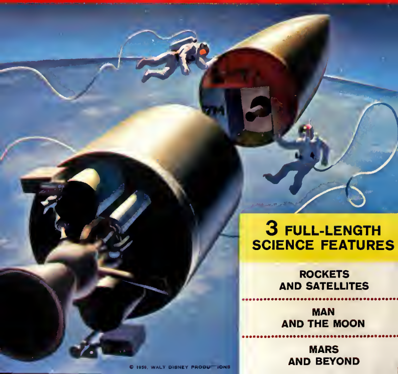

3 FULL-LENGTH SCIENCE FEATURES

ROCKETS AND SATELLITES

MAN AND THE MOON

MARS AND BEYOND

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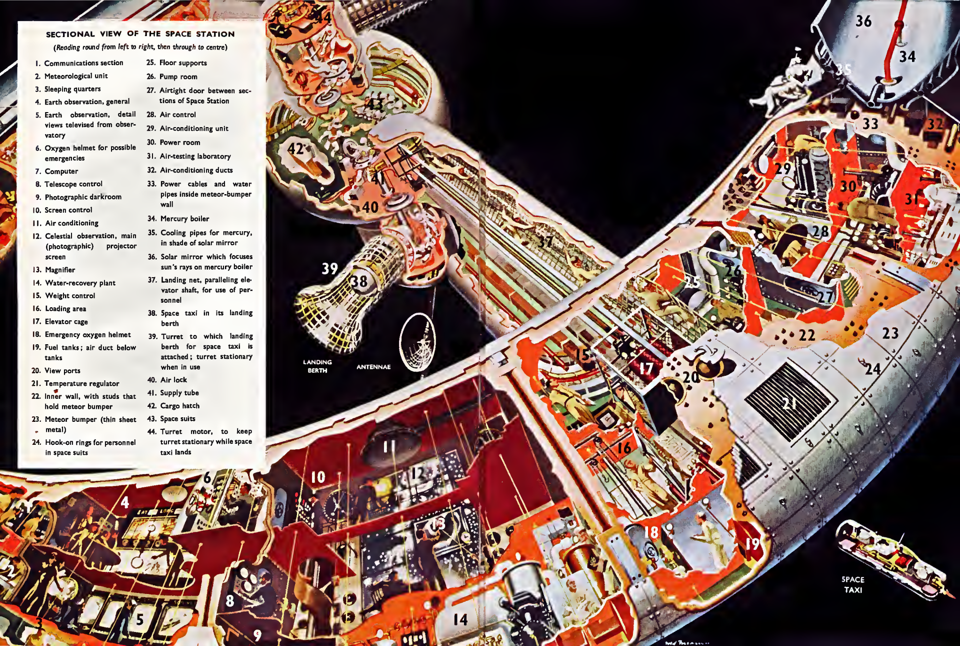
SECTIONAL VIEW OF THE SPACE STATION

(Reading round from left to right, then through to centre)

1. Communications section
2. Meteorological unit
3. Sleeping quarters
4. Earth observation, general
5. Earth observation, detail views televised from observatory
6. Oxygen helmet for possible emergencies
7. Computer
8. Telescope control
9. Photographic darkroom
10. Screen control
11. Air conditioning
12. Celestial observation, main (photographic) projector screen
13. Magnifier
14. Water-recovery plant
15. Weight control
16. Loading area
17. Elevator cage
18. Emergency oxygen helmet
19. Fuel tanks; air duct below tanks
20. View ports
21. Temperature regulator
22. Inner wall, with studs that hold meteor bumper
23. Meteor bumper (thin sheet metal)
24. Hook-on rings for personnel in space suits
25. Floor supports
26. Pump room
27. Airtight door between sections of Space Station
28. Air control
29. Air-conditioning unit
30. Power room
31. Air-testing laboratory
32. Air-conditioning ducts
33. Power cables and water pipes inside meteor-bumper wall
34. Mercury boiler
35. Cooling pipes for mercury, in shade of solar mirror
36. Solar mirror which focuses sun's rays on mercury boiler
37. Landing net, paralleling elevator shaft, for use of personnel
38. Space taxi in its landing berth
39. Turret to which landing berth for space taxi is attached; turret stationary when in use
40. Air lock
41. Supply tube
42. Cargo hatch
43. Space suits
44. Turret motor, to keep turret stationary while space taxi lands



In a great space station, 12 hungry men will probably start breakfast with Tang.

Orbiting the earth, they will have all the comforts of home.

Except gravity.

A floating world, where men will live and work for six months at a time. In a few years, it will be here.

And if the future is like the present, Tang will be in its galley. Just as it's on your kitchen table.

Nutritious, orange-flavored Tang Instant Breakfast Drink for spacemen and earth families.

Tang. With more vitamin C than orange juice.

TANG IS GENERAL FOODS TRADEMARK FOR INSTANT BREAKFAST DRINK

This silent morning, on Space Shuttle #28, breakfast will probably begin with Tang.™

Imagine a spaceship that carries 12 passengers and lands as easily as an airplane. It will be ferrying back and forth to space by the late 1970's.

And if the future is like the present, Tang will be in its galley. Just as it's on your kitchen table.

Nutritious, orange-flavored Tang. The instant breakfast drink with more Vitamin C than orange juice.

No matter where you are.

Tang. For spacemen. And earth families.

TANG IS GENERAL FOODS TRADEMARK FOR INSTANT BREAKFAST DRINK

On their 56th morning in outer space, three men will drink Tang™.

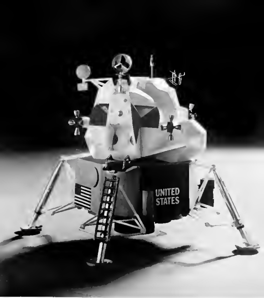
And then check Skylab's solar array wings one last time and set the instruments on their module towards home.

This will come true. In less than 3 years, man will actually learn to live for extended periods of time in the first manned space station.

And Tang will be on board. The same instant breakfast drink that's on your kitchen table. Orange-flavored Tang with more vitamin C than orange juice. Nutritious Tang.

For breakfast tomorrow.

TANG IS GENERAL FOODS TRADEMARK FOR INSTANT BREAKFAST DRINK.



It's ugly, but it gets you there.

THE COMPLETE BOOK OF
OUTER SPACE

Willy Ley
THE SPACE SHIP
Dr. Wernher Von Braun
STATION IN SPACE
Dr. Heinz Haber
SPACE MEDICINE
Hugo Gernsback
THE MOON
and every other top expert

Plus "THE FLYING SAUCER MYTH," Space-Travel Timetables, Space Dictionary

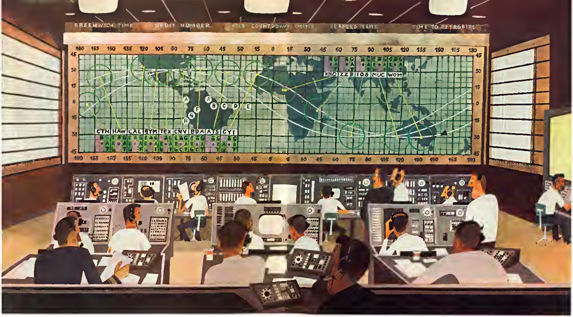
ROCKETS, MISSILES AND SATELLITES

By CLAYTON KNIGHT

The GIANT BOOK OF AMAZING STORIES

Thrill-a-minute Adventure

"Birdwatchers" at the Cape's press site. Thousands of others, usually less well equipped, crowd Cocoa Beach, and millions more throughout the country do their bird-watching by television.



Immediately after the launching of the Atlas, Mercury Control Center, a couple of miles away, takes over from the blockhouse and becomes the brain of the entire mission. With the help of the tracking stations all over the world, these men have complete control over every detail of the flight: the capsule and the condition of the astronaut up to his re-entry into the atmosphere, and the recovery of the man and his spacecraft.

All tracking stations and key information from them are displayed on this World Map:

CTN	Canton Island	CNV	Cape Canaveral	ZZB	Zanzibar
HAW	Kauai, Hawaii	BDA	Bermuda	IOS	Indian Ocean Ship
CAL	Point Arguello, California	ATS	Atlantic Ocean Ship	MUC	Muchea, Australia
GYM	Guaymas, Mexico	CYI	Canary Islands	WOM	Woomera, Australia
TEX	Corpus Christi, Texas	KNO	Kano, Nigeria		

40,000 people work on Project Mercury. Of these, 15,000 are engaged on the recovery, using 30 ships and hundreds of aircraft.

COMPLIMENT [illegible]
Red Ball ® JETS by BALL-BAND
theyre fast!

SPACE:
Man's New Frontier

A GLIMPSE INTO THE EXPLORATION OF SPACE

© 1962 by C. S. HAMMOND & Co., Maplewood, N. J.

A BUSY BEE BOOK

The Busy Bee
SPACE BOOK

THINGS TO DO
FOR BOYS & GIRLS
8 TO 12

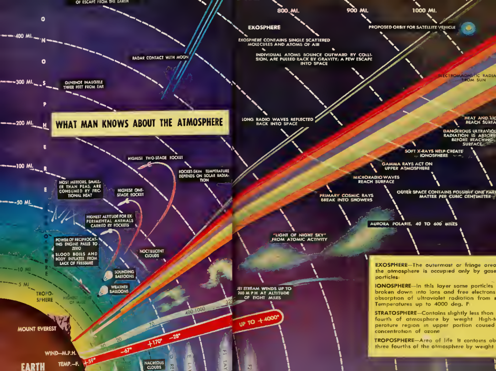
SPACE GAMES - MOON TALK
ROCKET SHIP TO MAKE

By the Editors of CHILD LIFE

Timothy's
SPACE BOOK

COLLINS WONDER COLOUR BOOKS

WHAT MAN KNOWS ABOUT THE ATMOSPHERE

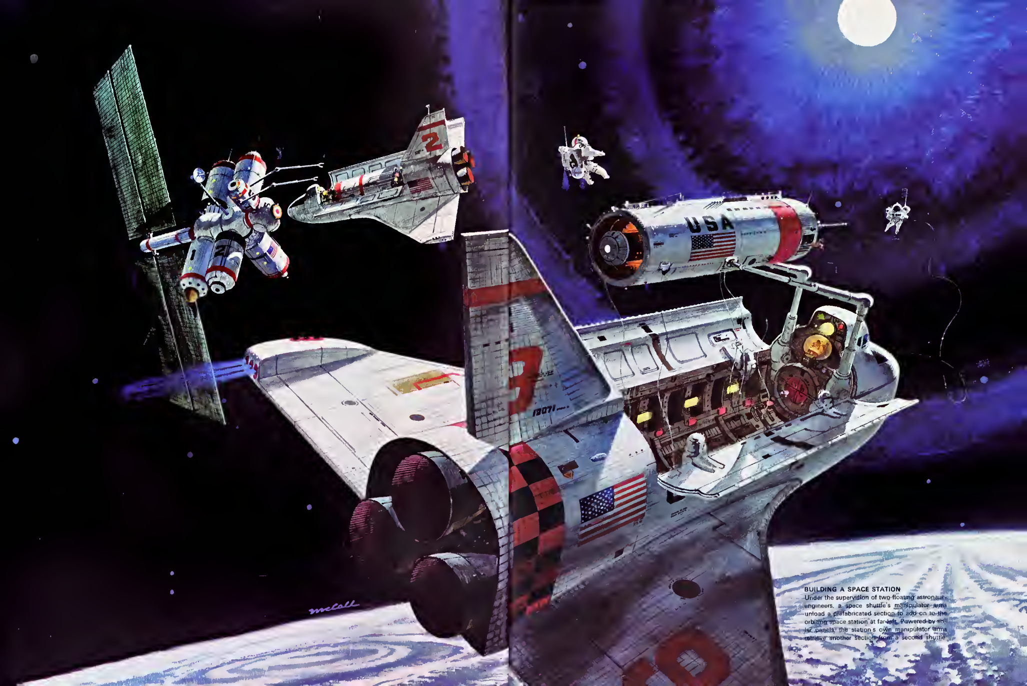

OF ESCAPE FROM THE EARTH
O
400 MI.
N
O
300 MI.
S
P
200 MI.
H
E
100 MI.
R
E
50 MI.
OZONOSPHERE
10 MI
5 MI
TROPOSPHERE
HIGHEST FLIGHT OF MAN
MOUNT EVEREST
WIND—M.P.H.
TEMP.—F.
EARTH
RADAR CONTACT WITH MOON
GUNSHOT INAUDIBLE THREE FEET FROM EAR
HIGHEST TWO-STAGE ROCKET
ROCKET-SKIN TEMPERATURE DEPENDS ON SOLAR RADIATION
MOST METEORS, SMALLER THAN PEAS, ARE CONSUMED BY FRICTIONAL HEAT
HIGHEST ONE-STAGE ROCKET
HIGHEST ALTITUDE FOR EXPERIMENTAL ANIMALS CARRIED BY ROCKETS
POWER OF RECIPROCATING ENGINE FALLS TO ZERO
BLOOD BOILS AND BODY INFLATES FROM LACK OF PRESSURE
NOCTILUCENT CLOUDS
SOUNDING BALLOONS
WEATHER BALLOONS
NACREOUS CLOUDS
90
20
70
400 1000
320
+59°
-67°
+170°
-28°
UP TO +4000°
JET STREAM WINDS UP TO 200 M P H AT ALTITUDE OF EIGHT MILES
800 MI.
900 MI.
1000 MI.
EXOSPHERE
EXOSPHERE CONTAINS SINGLE SCATTERED MOLECULES AND ATOMS OF AIR
INDIVIDUAL ATOMS BOUNCE OUTWARD BY COLLISION, ARE PULLED BACK BY GRAVITY; A FEW ESCAPE INTO SPACE
PROPOSED ORBIT FOR SATELLITE VEHICLE
LONG RADIO WAVES REFLECTED BACK INTO SPACE
ELECTROMAGNETIC RADIA FROM SUN
HEAT AND LIG REACH SURFA
DANGEROUS ULTRAVIOL RADIATION IS ABSORB BEFORE REACHING SURFACE
SOFT X-RAYS HELP CREATE IONOSPHERE
GAMMA RAYS ACT ON UPPER ATMOSPHERE
MICRORADIO WAVES REACH SURFACE
PRIMARY COSMIC RAYS BREAK INTO SHOWERS
OUTER SPACE CONTAINS POSSIBLY ONE PART MATTER PER CUBIC CENTIMETER
AURORA POLARIS, 40 TO 600 MILES
"LIGHT OF NIGHT SKY" FROM ATOMIC ACTIVITY

EXOSPHERE—The outermost or fringe area the atmosphere is occupied only by gase particles

IONOSPHERE—In this layer some particles broken down into ions and free electrons absorption of ultraviolet radiation from s Temperatures up to 4000 deg. F

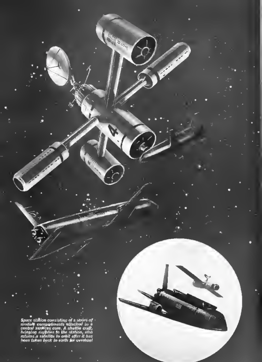
STRATOSPHERE—Contains slightly less than fourth of atmosphere by weight High-te perature region in upper portion caused concentration of ozone

TROPOSPHERE—Area of life It contains ob three fourths of the atmosphere by weight



BUILDING A SPACE STATION
Under the supervision of two floating astronaut-engineers, a space shuttle's manipulator arms unload a prefabricated section to add on to the orbiting space station at far left. Powered by solar panels, the station's own manipulator arms retrieve another section from a second shuttle

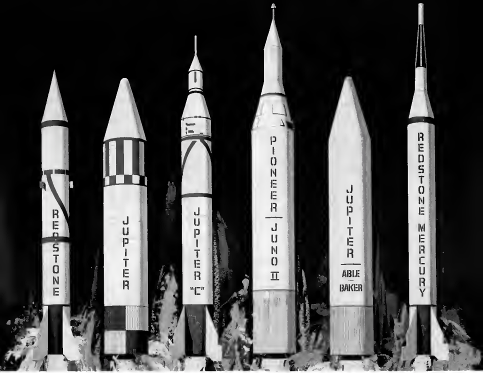
DANGER
EXPLOSIVES
IN MISSILE
GALBRAITH O'LEARY



Space station consisting of a series of module compartments attached to a central services core. A shuttle craft, bringing supplies to the station, also returns a satellite to orbit after it has been taken back to earth for overhaul

Boeing-Lockheed design for a space ferry craft. The swept delta-winged booster would take-off vertically with the lifting body ferry craft and then return to Earth. The ferry craft would then insert itself into orbit, where it could remain for two weeks

America's First Family of Rockets and Missiles



AUGUST 1953
FIRST successful firing of a large ballistic missile . . **REDSTONE**

MAY 1957
FIRST successful firing of an intermediate range ballistic missile . . . **JUPITER**

JANUARY 1958
FIRST free world satellite . **Explorer I** launched successfully at first attempt and still orbiting **JUPITER "C"**

MARCH 1959
FIRST free world solar satellite . . **Pioneer IV** first U. S. payload projected to permanent escape from earth . . **JUNO II**

MAY 1959
FIRST successful space travel and safe return of **Primates Able and Baker —JUPITER**

MAY 5, 1961
First U. S. manned space flight—project **Mercury** capsule—boosted by **REDSTONE**

Chrysler Corporation extends congratulations to all the people who cooperated in the first U. S manned space flight and in particular, astronaut Navy Commander Alan B. Shepard, Jr.

This flight was boosted by the reliable Redstone—a member of the first team of missiles in America's conquest of space.

This team has established an unequalled record fulfilling missions with reliability and accuracy.

The record is no accident. It is the product of a philosophy of building on proven principles and hardware. The carry-over of experience from the phenomenally reliable Redstone is largely responsible for the equally impressive performance of Jupiter. This inherent integrity is transferred to the succeeding generations of missiles.

There is something else behind this great record. Teamwork— a government-military-industry team working unselfishly in the best interests of the country.

Redstone is operational with U. S. Army forces. Jupiter is deployed by the Air Force. Redstone, Jupiter, Jupiter "C" and Juno II have served the missions of the Department of Defense and the National Aeronautics and Space Administration.

Chrysler Corporation is proud to have been a member of this most successful team since 1952. As prime contractor for the Redstone and Jupiter systems, we have worked closely with military and government scientists in taking these missiles from initial concept to the launching pad . . . and beyond. Broad Chrysler Corporation capability and experience in research, development, engineering, production and logistic support is supplemented by Chrysler operation of the Michigan Ordnance Missile Plant.

Today these missiles mean military strength to keep the peace. They are also the key to the door of a vastly expanded new world of knowledge which will contribute much to peace and a better way of life.

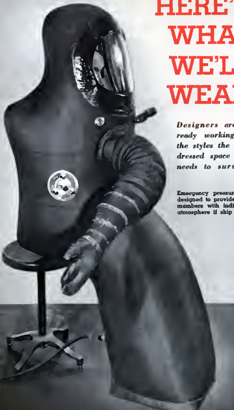
Chrysler Corporation

PLYMOUTH • VALIANT • DODGE • DART • LANCER • CHRYSLER • IMPERIAL • DODGE TRUCKS • MOPAR
REDSTONE • JUPITER • AIRTEMP • AMPLEX • CYCLEWELD • MARINE AND INDUSTRIAL ENGINES

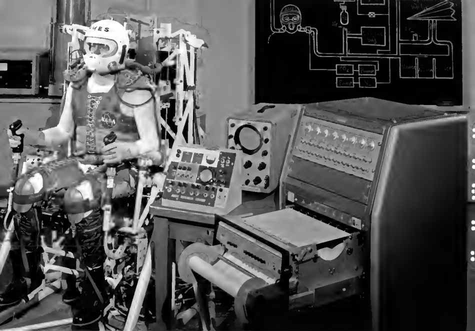
This public information advertisement is paid for by Chrysler Corporation

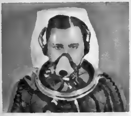
HERE'S WHAT WE'LL WEAR

Designers are already working on the styles the well-dressed space man needs to survive.

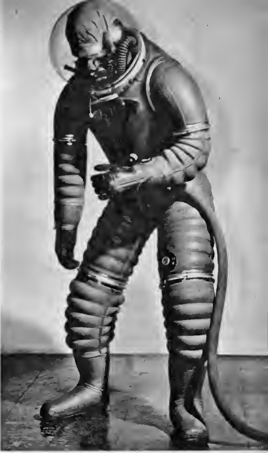


Emergency pressure cell designed to provide crew members with individual atmosphere if ship leaks.


AMES
AMES
O2
Air
Surplus bag
Wake
CO2
Pump
Pump
V2
Blower



Special plastic helmet supplies pressurization for entire head while subject undergoes negative gravity tests on centrifuge. It was found this ended red-out.



Early full pressure suit was not efficient. It looks impressive but it was clumsy and restrictive. Air Force has developed new space suit; the design is Top Secret.

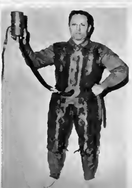
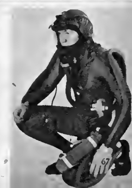
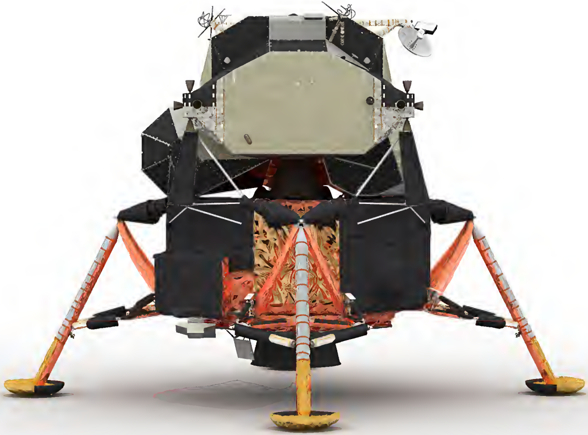


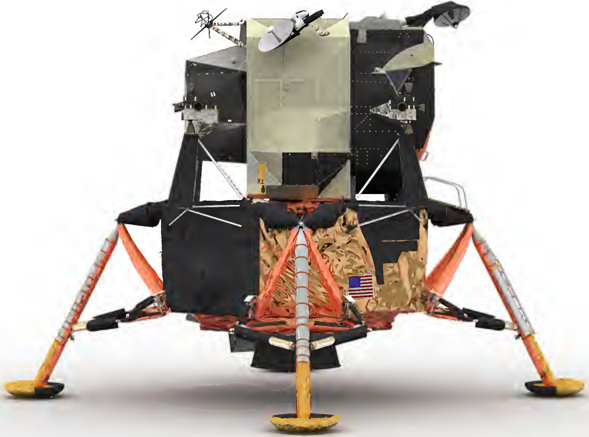
Photo at near right shows one of newest developments: a suit that is air-conditioned. Worn as a liner to full pressure suit, it dispels asphyxiating body heat.



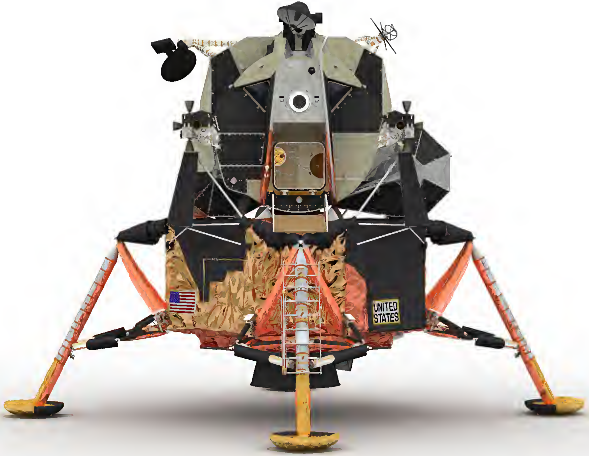
At far right is one of earliest experimental partial pressure suits with full pressure helmet. The combination worked but was not as good as new models.



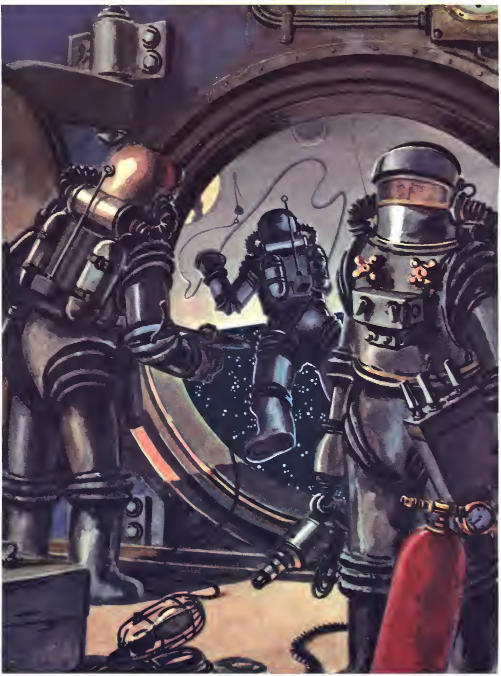
LM-5 John Ortmann 2006



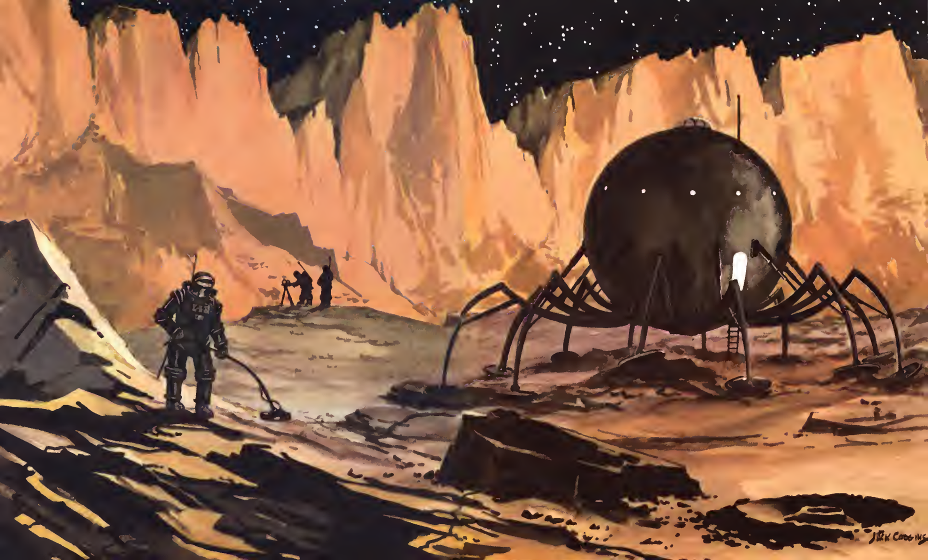
LM-5 John Ortmann 2006

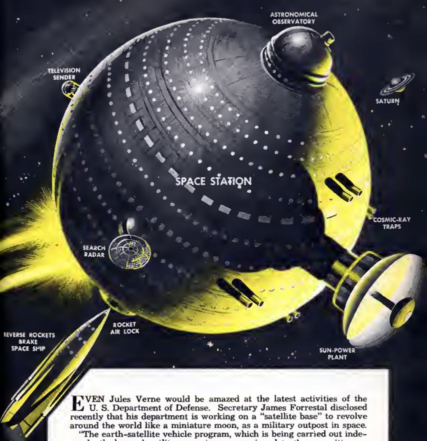


LM-5 John Ortmann 2006



Air-lock door open, space-suited repair crew goes into action. Man on left has just fired a magnetized, line-carrying projectile to damaged ship. Oxygen tanks, CO_2 absorption apparatus, batteries and radio are packed on back. Tools carried by man on foreground are operated from inside sleeve of suit. Sunvisors and magnetized boots will be necessary.


Jack Coggins



EVEN Jules Verne would be amazed at the latest activities of the U. S. Department of Defense. Secretary James Forrestal disclosed recently that his department is working on a "satellite base" to revolve around the world like a miniature moon, as a military outpost in space.

"The earth-satellite vehicle program, which is being carried out independently by each military service, was assigned to the committee on guided missiles for co-ordination," he revealed in his first annual report on the national military establishment. "To provide an integrated program with resultant elimination of duplication, the committee recommended that current efforts in this field be limited to studies and component designs. Well defined areas of research have been allocated to each of the three military departments."

There is considerable speculation as to just how far this program is meant to go. An earth satellite may be almost anything. It can range from a tiny bit of matter, projected into space for astronomical observation, to a permanent fortress on a skyhook.

We have already tried to hurl metal slugs into space. Last year at White Sands Proving Grounds, New Mexico, a V-2 rocket began firing these little man-made meteorites at 10-second intervals after reaching an altitude of 120,000 feet. The rocket zoomed up 111 miles above the earth and technical experts hoped that some of the slugs would escape the earth's gravity so that they could be studied as tiny satellites. From all reports, this space experiment was a failure.

No one but the scientists and the top brass know the exact nature of the next effort. It may be a preliminary, unmanned rocket, equipped with automatic instruments and a radio telemetering device for sending their data back to earth.

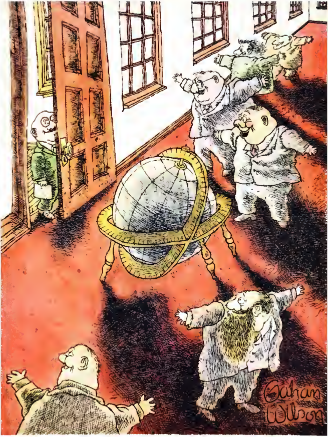
On the other hand, rocket development may have advanced far enough for us actually to build a small space ship. Such a rocket could carry several scientists on a limited observation flight around the globe, then return to base before exhausting its air supply.

Finally, with experience gained from this trial flight into space, we could plan a bigger ship that would transport the first prefabricated units for assembling a base in the sky.

During World War II, the Nazis toyed with the idea of setting up a mirror platform in space to beam the concentrated rays of the sun in a deadly "sun-gun." The first official hint that the U. S. was considering plans for its own secret weapon in space came to light in April, 1946. General Curtis E. LeMay had a cryptic item buried in an announcement then of his research program. A brief passage in this report called for development of "flight and survival equipment for use above the atmosphere, including space vehicles, space bases and devices for use therein."

With the rapid progress of scientific research in the past few years, we have seen the birth of atomic power and the phenomenal growth of aviation engines from wind-milling motors to mighty rockets streaking a plane like the Bell X-1 at a supersonic speed of 1700 mph. Unmanned rockets, like the Navy's new Neptune, are nearly ready to outstrip the Nazis' sensational V-2 and nudge the 250-mile mark.

Helicopters hover around this rocket ship to load provisions before it zooms off to the satellite base. Note foldaway landing gear and access ladders built into the leg wells of this tender, designed for shuttle service. To avoid contaminating the earth, rockets on the fins are used for takeoffs and landings. The atom jet is switched on only for travel in space.



"Professor Zlata! You're just in time to be the planet Neptune!"

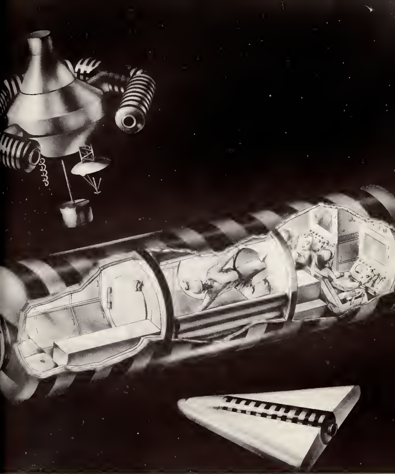
Bill Wray

USA
4

A YAK YAK PREDICTION

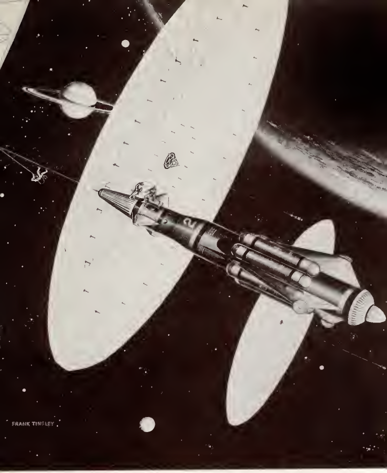
The first man on the moon will be a dog catcher!

No doubt about it! How else can the moon be made safe for man unless somebody rounds up all the rats, dogs, cats, monkeys and guinea pigs previously sent!?

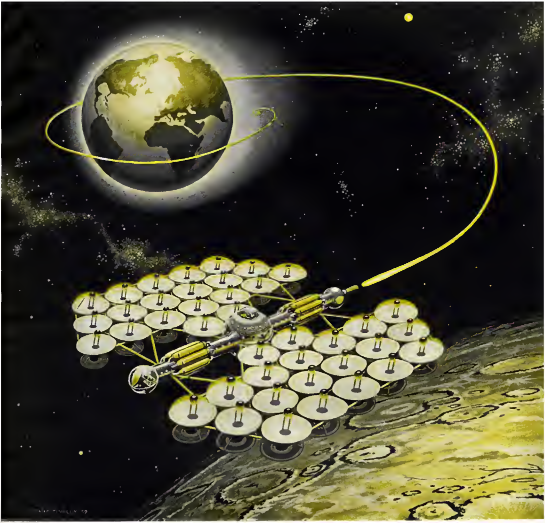


In weightless spoce flight, component of spoce stotion opprooches its destinotion. Winged component prepores for re-entry into earth's otmosphere.

Servicing an Orbiting Satellite *(courtesy, Grumman Aircraft)*



Passing one of Saturn's moons, the spacecraft's crew detaches their ferry-rocket from its mile-across solar-radiation propelled sail.



STEPS IN THE RACE TO OUTER SPACE

Cosmic Butterfly

Spreading its wings to absorb the eternal flow of solar energy is the Cosmic Butterfly, a space vehicle of a type first conceived by Dr. Ernst Stuhlinger of Redstone Arsenal.

Each of the fifty-foot parabolic mirrors in the wings concentrates the Sun's rays on a boiler at its focal point. Steam is developed, which drives a 200-kw turbogenerator in the base. Cooled by frigid outer space in heat diffusers, the steam reverts to water and is pumped back to the boiler to be used over and over again.

The current thus generated drives the main propulsion unit, an ion rocket in which powerful electric fields accelerate charged particles, shooting them from the rear of the rocket exactly as the electron gun in your TV set bombards the screen. Sunlight, then, is the power source, whereas cesium is the propellant material.

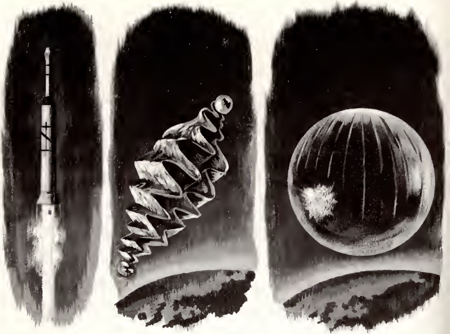
While the recoil thrust is relatively small, the weightless vehicle is operating in a vacuum and the push is enough to enable the Butterfly to reach interplanetary speeds. Unlike conventional rockets, the Butterfly is under power the entire trip. Half way to its destination it turns around, and the ion thrust is used to slow the craft down to arrival speeds.

Since its thrust is entirely inadequate to cope with the gravity of major planets, the Cosmic Butterfly never lands. It is assembled in space and shuttles between artificial satellites.

The Cosmic Butterfly could carry ten passengers and 50 tons of cargo from an Earth satellite to a comparable one orbiting around Mars in about one year of continuous travel.

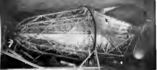
Inertial navigation systems will play an increasing role in the exploration of outer space. ***ARMA***, now providing such systems for the Air Force ATLAS ICBM, will be in the vanguard of the race to outer space. ***ARMA*** . . . Garden City, New York. A Division of American Bosch Arma Corporation.

AMERICAN BOSCH ARMA CORPORATION



FRANK TINSLEY '58

INSIDE GROUND STATION RADOME AT ANDOVER, MAINE [illegible] antenna [illegible] [illegible] signals to [illegible] strong powerful beam. The same antenna also [illegible] [illegible]



New "TELSTAR" relays phone calls and TV pictures for first time!

Bell System microwave-in-sky satellite is latest communications triumph for America arising from telephone research

The world's first private enterprise communications satellite is now being used for dramatic experiments in relaying telephone calls and television internationally.

Its name: Telstar. It was launched from Cape Canaveral at Bell System expense by the National Aeronautics and Space Administration.

Telstar receives signals beamed to it from a ground station, amplifies them and transmits them to another station on the ground below—perhaps an ocean away from the first one. The new satellite thus acts as a microwave relay station in the sky, enabling voices, TV pictures and data messages to leap thousands of miles in a new and exciting way.

The ground stations in the U.S. now being used for Telstar were built by the Bell System at Andover, Maine, and Holmdel, New Jersey. Organizations abroad have built stations in England and France. The latter, a near replica of the station in Maine, was assembled with Bell System cooperation. A receiving station in Italy will be ready late this year and another in West Germany next year.

Telstar is a major experimental step toward a world-wide satellite communications system that was first proposed as a practical venture at Bell Telephone Laboratories. Progress toward such a system has depended on many contributions by the private communications industry, including six basic components—the transistor, the solar battery, the traveling wave tube, ruby masers, the wave-guide and new antennas for the ground stations with innovations in circuitry—direct outgrowths of Bell System research and development.

Above all else, Telstar is the latest achievement in an unending Bell System quest—the search for ways to make your telephone service still better, more economical and more useful.

BELL TELEPHONE SYSTEM

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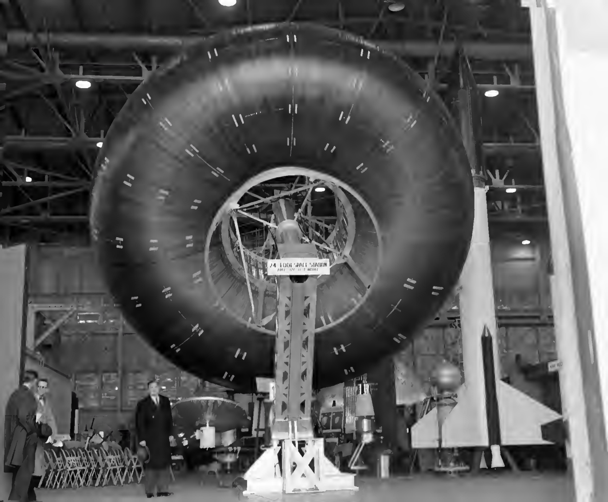
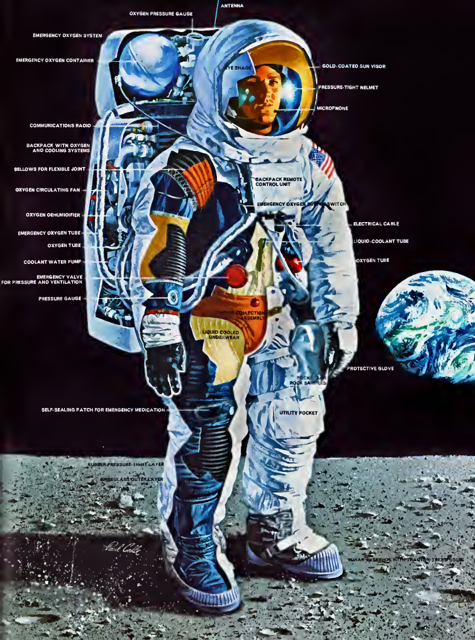

24 FOOT SPACE STATION
FULL SIZE TEST MODEL


ANTENNA
OXYGEN PRESSURE GAUGE
EMERGENCY OXYGEN SYSTEM
EMERGENCY OXYGEN CONTAINER
EYE SHADE
GOLD-COATED SUN VISOR
PRESSURE-TIGHT HELMET
MICROPHONE
COMMUNICATIONS RADIO
BACKPACK WITH OXYGEN AND COOLING SYSTEMS
BELLOWS FOR FLEXIBLE JOINT
BACKPACK REMOTE CONTROL UNIT
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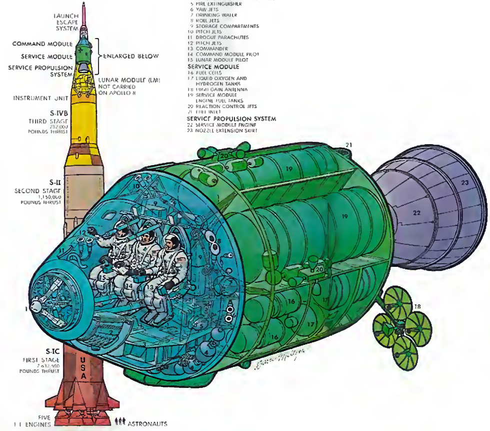
OXYGEN TUBE
EMERGENCY VALVE FOR PRESSURE AND VENTILATION
PRESSURE GAUGE
URINE COLLECTION ASSEMBLY
LIQUID COOLED UNDERWEAR
PROTECTIVE GLOVE
POCKET FOR ROCK SAMPLES
SELF-SEALING PATCH FOR EMERGENCY MEDICATION
UTILITY POCKET
RUBBER PRESSURE-TIGHT LAYER
FIBREGLASS OUTER LAYER
Paul Calle
LUNAR OVERSHOE WITH TRACTOR TREAD SOLE

COMMAND MODULE
1 DOCKING PROBE
2 MAIN PARACHUTES
3 FOOD COMPARTMENT
4 REACTION CONTROL FUEL TANKS
5 FIRE EXTINGUISHER
6 YAW JETS
7 DRINKING WATER
8 ROLL JETS
9 STORAGE COMPARTMENTS
10 PITCH JETS
11 DROGUE PARACHUTES
12 PITCH JETS
13 COMMANDER
14 COMMAND MODULE PILOT
15 LUNAR MODULE PILOT

SERVICE MODULE
16 FUEL CELLS
17 LIQUID OXYGEN AND HYDROGEN TANKS
18 HIGH GAIN ANTENNA
19 SERVICE MODULE ENGINE FUEL TANKS
20 REACTION CONTROL JETS
21 FUEL INLET

SERVICE PROPULSION SYSTEM
22 SERVICE MODULE ENGINE
23 NOZZLE EXTENSION SKIRT



L. TEECE

Project Apollo

Mission to the Moon

by CHARLES COOMBS

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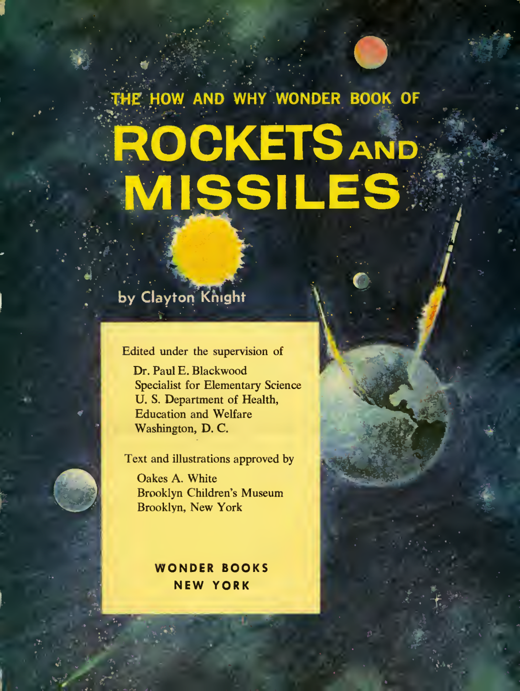


THE HOW AND WHY WONDER BOOK OF

ROCKETS AND MISSILES

by Clayton Knight

Edited under the supervision of

Dr. Paul E. Blackwood
Specialist for Elementary Science
U. S. Department of Health,
Education and Welfare
Washington, D. C.

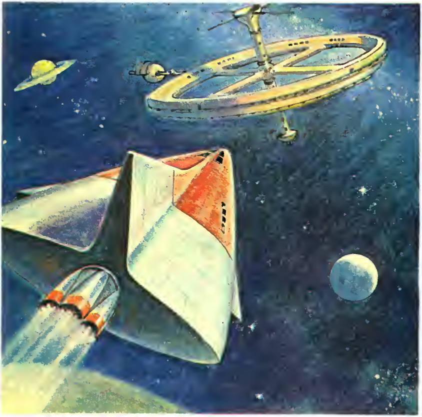
Text and illustrations approved by

Oakes A. White
Brooklyn Children's Museum
Brooklyn, New York

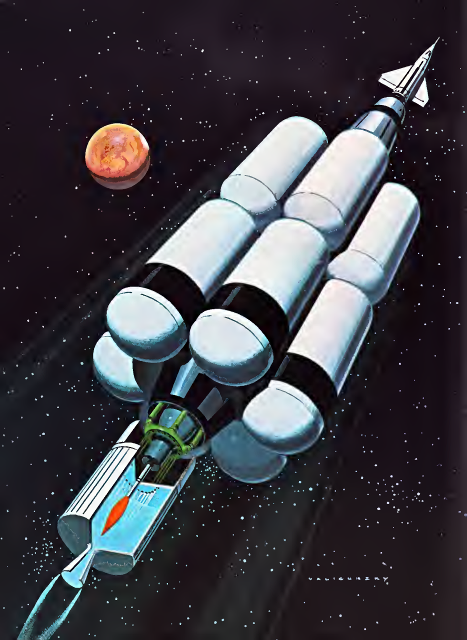
WONDER BOOKS
NEW YORK

WHEN WILL TRUE SPACE TRAVEL BEGIN?

BEFORE it is safe for man to travel in outer space, there are many frightening hazards for which scientists must find answers. Experts already know about the dangers from cosmic rays, a band of intense radiation, wandering meteorites, blast-off speeds and the problem of re-entry. Only after searching experiments and exploratory dyna-soar flights by volunteers into the fringes of the earth's atmosphere will man be free to journey to the other planets, with stopovers at space stations orbiting around the earth.



In the future, manned space stations orbiting around the earth may be visited regularly by shuttle-craft with supplies and men.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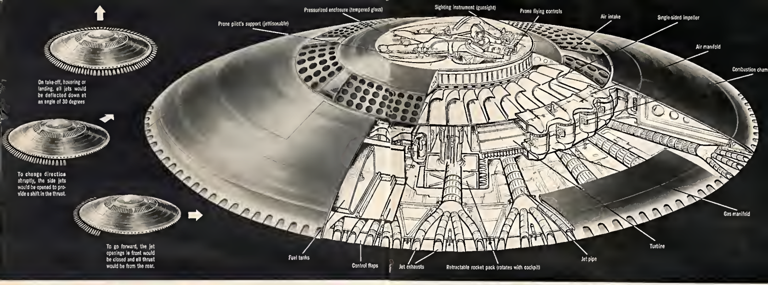
Farewell to Farnborough's "annual" show

We fly the Musketeer

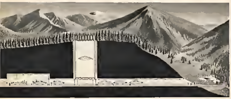

Pressurized enclosure (tempered glass)
Prone pilot's support (jettisonable)
Sighting instrument (gunsight)
Prone flying controls
Air intake
Single-sided impeller
Air manifold
Combustion cham
Gas manifold
Turbine
Jet pipe
Retractable rocket pack (rotates with cockpit)
Jet exhausts
Control flaps
Fuel tanks

On take-off, hovering or landing, all jets would be deflected down at an angle of 30 degrees

To change direction abruptly, the side jets would be opened to provide a shift in the thrust.

To go forward, the jet openings in front would be closed and all thrust would be from the rear.

This design study for a flying-saucer fighter was prepared for LOOK by Thomas Turner, a 30-year-old British aeronautical engineer now employed by Republic Aviation Corp. A Canadian saucer project that may resemble it in some details has long been rumored. Turner points out that the design could be arrived at independently and is only one of several possible approaches to the construction of saucer craft.



Future airports built for vertically rising flying saucers would have no need of the long, vulnerable runways today's fighters require. The complete operation could go underground. Tunnels with take-off shafts set into the ground, complete with maintenance bays, fuel and crew quarters, would be bombproof shelters for a saucer squadron. The shafts would be sealed after take-off for camouflage and protection.

Produced by BEN KOCIVAR

Is this the real FLYING SAUCER?

This revolutionary design study envisions a craft that will outrun and outmaneuver present jets and eliminate vulnerable runways needed by our air guardians

DESPITE HUNDREDS OF "eyewitness" accounts of flying saucers, none has been captured and no government has come forward to take credit (or blame) for their reported aerial shenanigans. So, barring the possibility that the saucers are from other planets (a theory ardently supported by science-fiction fans), it seems reasonable to conclude that "there ain't no such animal."

But persistent and fairly credible rumors recur that a Canadian aircraft manufacturer, A. V. Roe, Canada, Ltd., has had a saucer design under development for two years. One report has it that the project was abandoned by the Canadian government because it would cost over $75 million to get a prototype flying model into the air. The A. V. Roe people maintain a confusing silence about the whole thing. They can't deny the project has been abandoned because they never announced it had begun. Our own Air Force offers "no comment."

At a recent meeting of engineers, it was indicated that, while flying saucer or sphere projects may still be purely hypothetical, new air-defense problems are setting up requirements for aircraft performance that would seem to be most ideally met by a saucer craft such as is illustrated above.

One problem, recently stated by Brig. Gen. Benjamin Kelsey, deputy director of research and development of the Air Force, is this: "Airplanes today spend too much time gathering speed on the ground and not enough flying in the air." Today's fighters, he pointed out, need extremely long runways and there are few in existence that are now long enough. These few, and the concentration of planes using them, provide a worth-while target for an A-bomb. With a single blow, the enemy might cripple a substantial portion of our air defense.

Planes that could take off vertically would not need long runways, which cost millions of dollars. They could be dispersed widely and safely. In this country, four vertical-rising aircraft already have been revealed. All but one, however, are modifications of conventional plane designs. None yet approaches the performance a true saucer might be capable of.

What are the requirements of an ideal defense fighter? 1) Ability to take off and land vertically; 2) high speed of over Mach 2 (more than 1500 mph); 3) high rate of climb; 4) excellent maneuverability; 5) heavy armament; 6) ability to operate at 60,000 feet.

These sketches indicate a highly educated guess of what a flying saucer to fulfill these requirements would look like. It provides for a one-man crew, housed in a glass bubble that would provide excellent visibility. The prone position of the pilot not only allows improved streamlining but also enables the pilot to withstand high accelerations and quick turns. The design contemplates use of cannon, rockets or guided missiles. Exact armament would depend on the mission. The target would be sighted by radar, and actual firing would be computed and accomplished electronically, as in several interceptors now in operation.

continued

aventures dans l'espace

PILOTES de L'ESPACE

par W. Ley

The Man Who Thinks For Himself Knows...

ONLY VICEROY HAS A THINKING MAN'S FILTER... A SMOKING MAN'S TASTE!

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LET'S PREPARE FOR AN ATTACK FROM OUTER SPACE!

"Operation Showdown":

HOW MUCH TIME TO DOOMSDAY?

April 35c

ALL FACT -- NO FICTION!

What the Medics say about

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THE MYSTERY OF ZERO GRAVITY

BONUS!

Book-Length True Life Thriller!

I WAS A SPACE SLAVE IN SPUTNIKGRAD!

WANTED!

Thousands of Men for exciting Space Jobs!

(see page 30)

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INTERNATIONAL

RUSSIA'S FEAT Where It Leaves U.S. in the Race to the Moon

ALSO IN THIS ISSUE

Report on U.S. Economy

The masterpieces of Andrea Mantegna

Genesis of 'The Power and the Glory'—by Graham Greene

ILLUSTRATION OF THE TWO SOVIET CAPSULES IN ORBIT AS THE SUN RISES OVER THE EARTH

HOW MUST MAN BE PROTECTED IN SPACE VEHICLES?

DURING journeys into space, humans must carry with them a sufficient supply of oxygen, food and liquid to last until their return to earth. They must also be protected against searing heat, bitter cold, and shielded against intense radiation known to exist in bands around the earth. Man must be held in place during rapid acceleration and brutal deceleration while leaving and returning to our atmosphere. Once in space, he must learn to cope with the problems of weightlessness and periods of complete inactivity.

THE AIR FORCE MA-I HELMET FOR OUTER SPACE

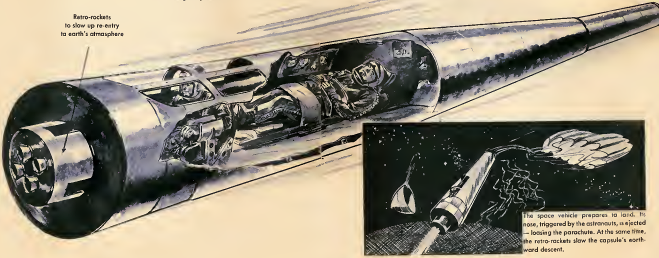
WHAT IS PROJECT MERCURY?

AMERICA'S PROJECT MERCURY has three objectives: to study man's ability to travel in space; to place a manned satellite in orbit around the earth; and to return the pilot safely to earth.

In 1961, Navy Commander Alan B. Shepard, Jr. and Marine Captain Virgil I. Grissom, in their individual flights in the Mercury capsules *Freedom 7* and *Liberty Bell 7*, made the first manned space flights for the United States. Commander Shepard, America's first astronaut, was launched in a 2,000-pound Mercury capsule tbat was boosted by a Redstone rocket. The manned craft traveled at a speed of 4,500 mph. It reached an altitude of 115 miles during the 15-minute sub-orbital flight, which occurred on May 5.

The Mercury space capsule, 7 feet in diameter at its base and 10 feet long, holds the pilot. This cone-shaped capsule eventually will be a satellite that is placed in orbit by a rocket. The orbit will be 100 to 150 miles above the earth. Retro-rockets, attached to the capsule, are fired at re-entry time. This slows the capsule so that it can return to earth.

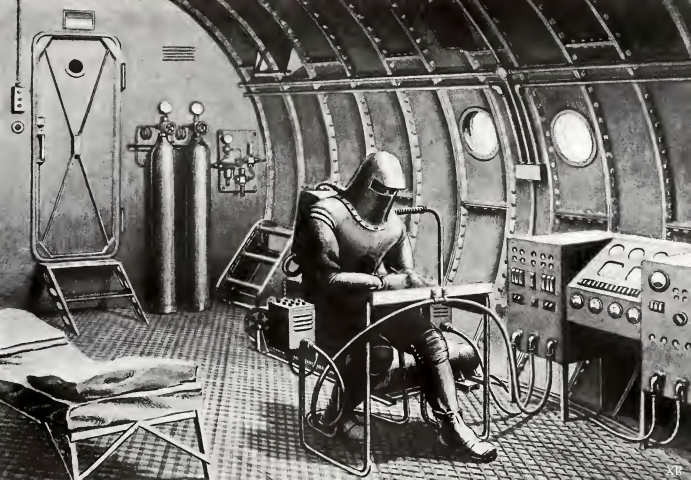
A special shield protects the pilot from the intense heat that is generated when the capsule re-enters the earth's atmosphere.



Artist's conception, cutaway view, of a space capsule of a type to follow *Project Mercury*. This larger capsule carries two astronauts.

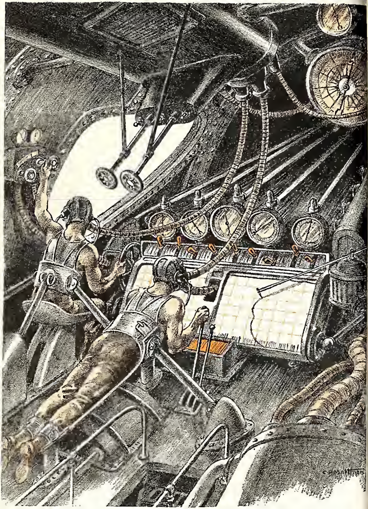
Retro-rockets to slow up re-entry to earth's atmosphere

The space vehicle prepares to land. Its nose, triggered by the astronauts, is ejected — loosing the parachute. At the same time, the retro-rockets slow the capsule's earthward descent.



XR

At the Controls of an Aircraft of the Future



An Artist's Conception of the Way Rockets Will Be Guided in Their Flights through Space by Pilots Strapped in a Sealed Compartment

---

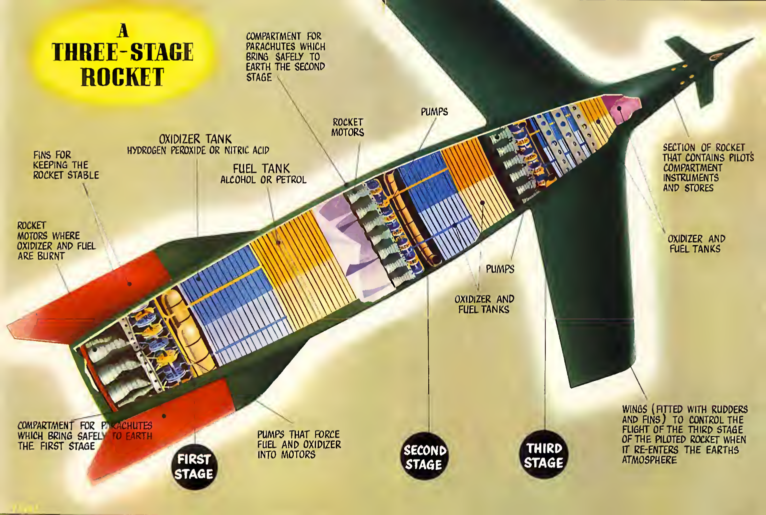
MAN-CARRYING ROCKET SHIPS PRESENT MANY PROBLEMS

Rocket-propelled airships of the future may resemble present-day Zeppelins, except that they will be equipped with stubby wings that telescope into the sides of the craft when not needed. Ships big enough to carry passengers still present many problems, but those experimenting with such a form of travel are already speculating on the construction and operation of the craft when they do make their appearance. Some German inventors believe these ships will be catapulted into the air as is now done with airplanes, and will ascend at the start with the aid of short wings. Upon reaching the stratosphere, the wings might be withdrawn into the hull after which rockets alone would provide the power. In leaving the earth, the speed of the craft would be held down because the occupants would be unable to withstand the tremendous pressure, but at a height of about 600 miles, the ship might be expected to attain its full speed, estimated at 250 miles a minute, a journey from Paris to Chicago requiring fifteen minutes at such a rate. The crew of a rocket ship of this sort would be strapped in places in an air-tight compartment with its own oxygen and heating plant. At a speed of 250 miles a minute, or 15,000 miles an hour, landing would present as much of a problem as the actual flight. In descending, experimenters believe the wings would again be brought into use and possibly rockets in the bow would be employed to aid in braking and reducing speed.

BAKELITE HATS FOR POLICE GIVE EXTRA PROTECTION

German policemen now are wearing bakelite hats. Recently the standard equipment for such peace officers was changed to include molded helmets which afford protection and are more durable than steel. The headpieces resemble the patent-leather dress helmets worn by German officers during the war.

A THREE-STAGE ROCKET


COMPARTMENT FOR PARACHUTES WHICH BRING SAFELY TO EARTH THE SECOND STAGE
ROCKET MOTORS
PUMPS
OXIDIZER TANK HYDROGEN PEROXIDE OR NITRIC ACID
FUEL TANK ALCOHOL OR PETROL
FINS FOR KEEPING THE ROCKET STABLE
ROCKET MOTORS WHERE OXIDIZER AND FUEL ARE BURNT
SECTION OF ROCKET THAT CONTAINS PILOT'S COMPARTMENT INSTRUMENTS AND STORES
OXIDIZER AND FUEL TANKS
PUMPS
OXIDIZER AND FUEL TANKS
WINGS (FITTED WITH RUDDERS AND FINS) TO CONTROL THE FLIGHT OF THE THIRD STAGE OF THE PILOTED ROCKET WHEN IT RE-ENTERS THE EARTHS ATMOSPHERE
COMPARTMENT FOR PARACHUTES WHICH BRING SAFELY TO EARTH THE FIRST STAGE
PUMPS THAT FORCE FUEL AND OXIDIZER INTO MOTORS
FIRST STAGE
SECOND STAGE
THIRD STAGE

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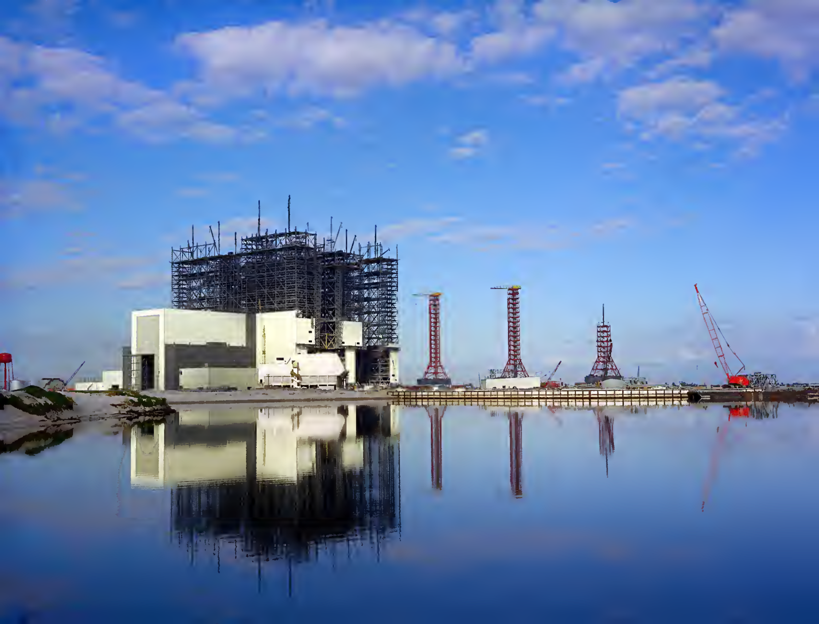
ROCKET TO THE MOON

—No longer a fantastic dream—Page 89

USA



UNITED STATES

Exploring inner space

Small spaceman makes big discoveries about Ford interiors

Scene. Ford showroom. While his parents choose their '63 Ford, the astronaut explores. ■ First surprise – Swing Away steering wheel moves over, making entry easy (for adults, too). ■ Spaceman inspects console, plush carpeting, sporty floor-mounted shift, crank-vent windows – finds all systems GO (in luxury).

Bright idea – illuminated glove compartment. Spaceman likes bucket seats (will recommend them for school bus). ■ Door lights! *Red* warns traffic, white lights your way in. ■ Space booster. roomy, well lined, illuminated trunk. ■ *Fairlane* is rated A-O.K. (Note to spaceman's mother. Ford vinyl is soil-resistant).

For major space problems. Ford wagons – most loadspace in low-price field. ■ High-flying compact *Falcon Sprint* with tachometer, sporty steering wheel Spaceman's final report to nation: all Ford interiors are . . . out of this world.

■ The beautiful exteriors of today's Fords are matched by beautiful interiors. And this beauty isn't just a thin veneer of glamor – it's solid, substantial luxury. ■ Example: Ford's deep-pile carpeting outlasts ordinary car carpeting because it has extra nylon and more loops per square yard. ■ Ford vinyl is heavier, more durable than the vinyl used in other cars. ■ Ford interiors are protected against weather and noise by one-third more insulation than America's other best-selling car. ■ And Fords are designed for comfort. Door openings are higher and wider than other cars in Ford's field . . . passenger space is more than in some medium-price cars. ■ Before you decide on any new car, explore a 1963 Ford – inside and out.

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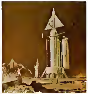

Never before has a film TV series attempted to tell the true and thrilling story of man's plunge into outer space. Every episode is a dramatic portrayal of adventures and experiments actually taking place today and planned for tomorrow. Lucky Strike is proud to bring this amazing and compelling show into your home.

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BILL LUNDIGAN
star of
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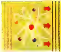

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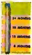

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MORE MILEAGE FROM EVERY DROP. Every drop of COLORESSENCE writes 2 times as many words as a drop of the best ball-point ink ever made before.

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TO THE STARS!

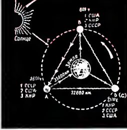
CLASSICS *Illustrated*

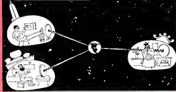
Special Issue

35c

Russian Proposes GLOBAL TV

THE RATHER LIMITED conception of radio transmission we had back in 1925, when we wondered whether radio waves could be propagated through space (see opposite page), has progressed to a stage where today we are near the point of transmitting television through space. With the launching of the first Sputnik last October, the dream of global TV received a tremendous shot in the arm and it has gathered momentum with each additional satellite thrown into the sky—both Russian and American.





How three satellites would bounce TV signals to each other and to ground stations is shown in diagram above, taken from Russian magazine "Radio." CWA is U.S., KHP is China, and CCCP is USSR. "A" would transmit Russian signals, "B" American signals, "C" Chinese signals. At left: how a U. S. cartoonist sees it.

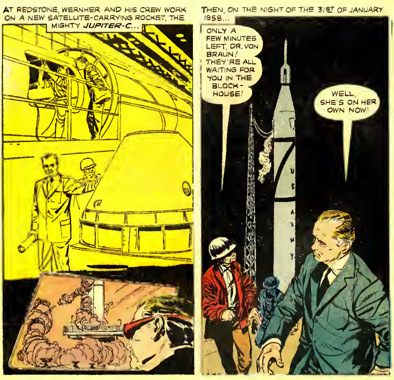
The magazine which first published data on Sputnik I, the Soviet periodical *Radio*, has outlined a plan which would allow nearly every TV set anywhere on earth to pick up a program transmitted from any other point. Television today, of course, is pretty much limited by line of sight, except in those areas which have coaxial cables, and a few spots which are equipped with over-the-horizon scatter facilities. The system proposed by engineer V. Petrov would make use of satellites which would pick up signals from stations on earth and bounce them to other satellites for more distant relay.

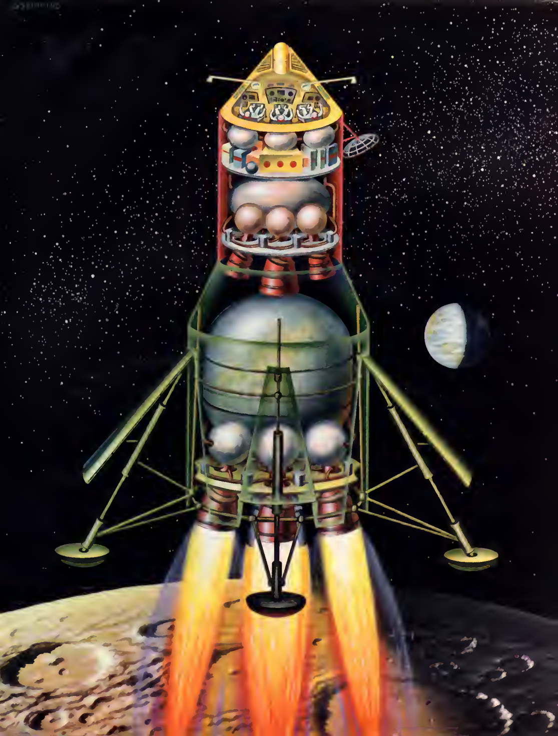
"STATIONARY" SATELLITES

If a satellite is launched from the equator so that it follows an eastward track at the proper speed and height, it will remain over one spot on

(*Continued on page* 53)

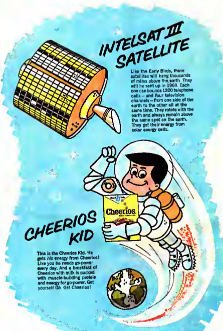
SF2


AT REDSTONE, WERNHER AND HIS CREW WORK ON A NEW SATELLITE-CARRYING ROCKET, THE MIGHTY *JUPITER-C*...
THEN, ON THE NIGHT OF THE 31ST OF JANUARY 1958...
ONLY A FEW MINUTES LEFT, DR. VON BRAUN! THEY'RE ALL WAITING FOR YOU IN THE BLOCK-HOUSE!
WELL, SHE'S ON HER OWN NOW!
U S ARMY



Discovering AEROSPACE

Book of SPACE ADVENTURES



INTELSAT III SATELLITE

Like the Early Birds, these satellites will hang thousands of miles above the earth. They will be sent up in 1968. Each one can bounce 1200 telephone calls—and four television channels—from one side of the earth to the other all at the same time. They rotate with the earth and always remain above the same spot on the earth. They get their energy from solar energy cells.

CHEERIOS KID

This is the Cheerios Kid. He gets *his* energy from Cheerios! Like you he needs go-power every day. And a breakfast of Cheerios with milk is packed with muscle-building protein and energy for go-power. Get yourself Go Get Cheerios!

General Mills

HOW WILL ASTRONAUTS EXIST ON THE MOON?

They will have to carry their own atmosphere and "climate" with them. The moon has no air and the temperature ranges from very hot to very cold. Out of the "bug" spacecraft, on the moon's surface, astronauts will carry tanks of oxygen and air-conditioning units on their backs. They will wear pressure suits that are heat-proof, cold-proof and airtight. Cool air will flow continuously from the units into their suits to keep the astronauts alive and comfortable.

Probably the first astronauts on the moon will stay for only about fifteen minutes. Later they may remain longer in a hut specially built and sent to the moon for this purpose.

HOW WILL ASTRONAUTS TRAVEL ON THE MOON?

To explore the moon, astronauts will have to walk around or drive around on the moon. Since nobody is sure what the surface is like, how will astronauts manage this task?

Engineers have designed shoes that will make walking possible on any kind of surface. And they have built a special kind of caterpillar tractor. It will be able to crawl slowly over smooth or rough places, over hard or soft surfaces.

In such a tractor, the astronauts might be able to explore the moon. They could then report back to earth the kind of information that only on-the-spot eye witnesses can discover and interpret.

THE QUESTION AND ANSWER BOOK OF SPACE

By RUTH A. SONNEBORN

Illustrated by JOHN POLGREEN

WHAT IS THE CAPSULE OF A SPACECRAFT?

WHO WAS THE FIRST MAN TO WALK ON THE MOON?

WHAT IS A THREE-STAGE ROCKET?

WHERE DOES SPACE BEGIN?

WHAT IS NOSE-TO-NOSE DOCKING?

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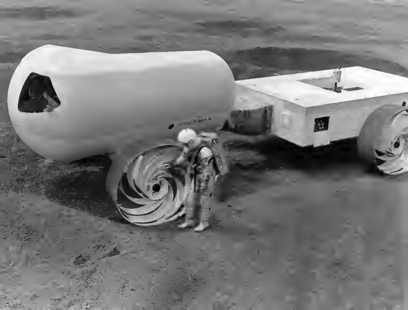

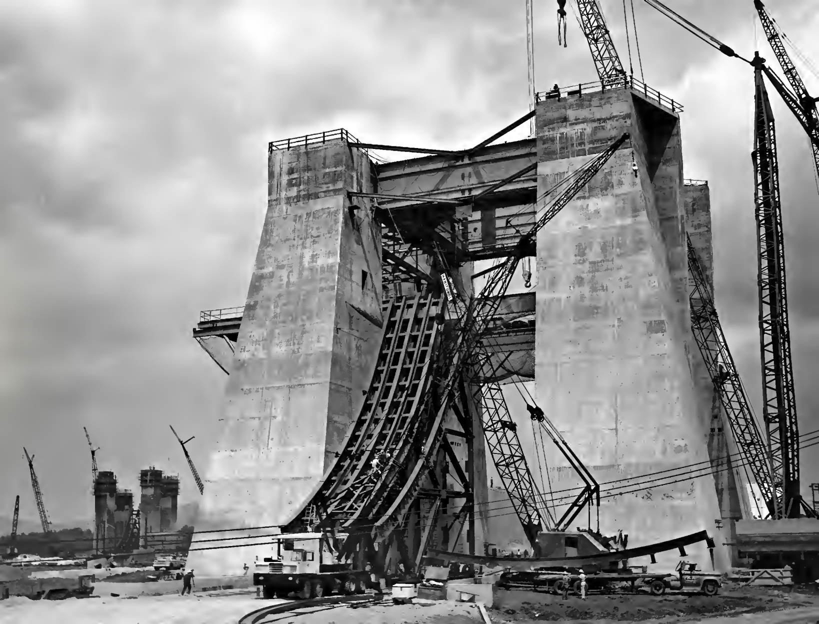
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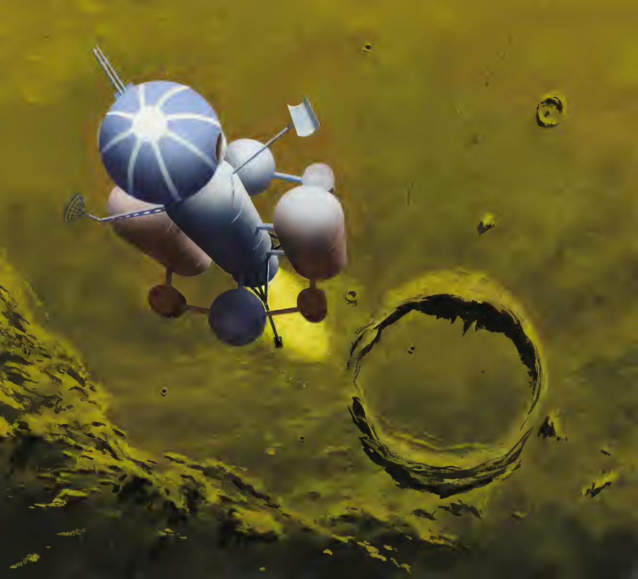
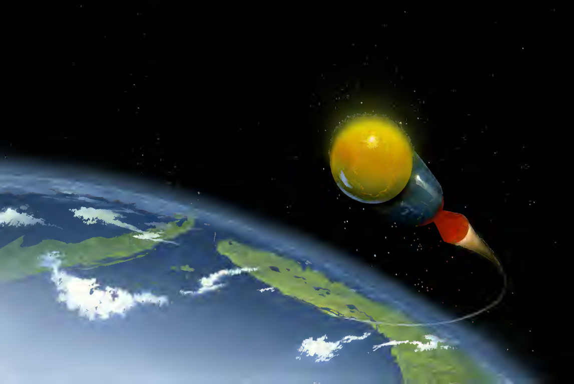
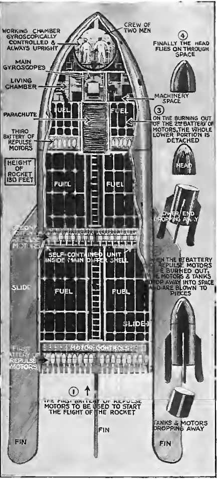
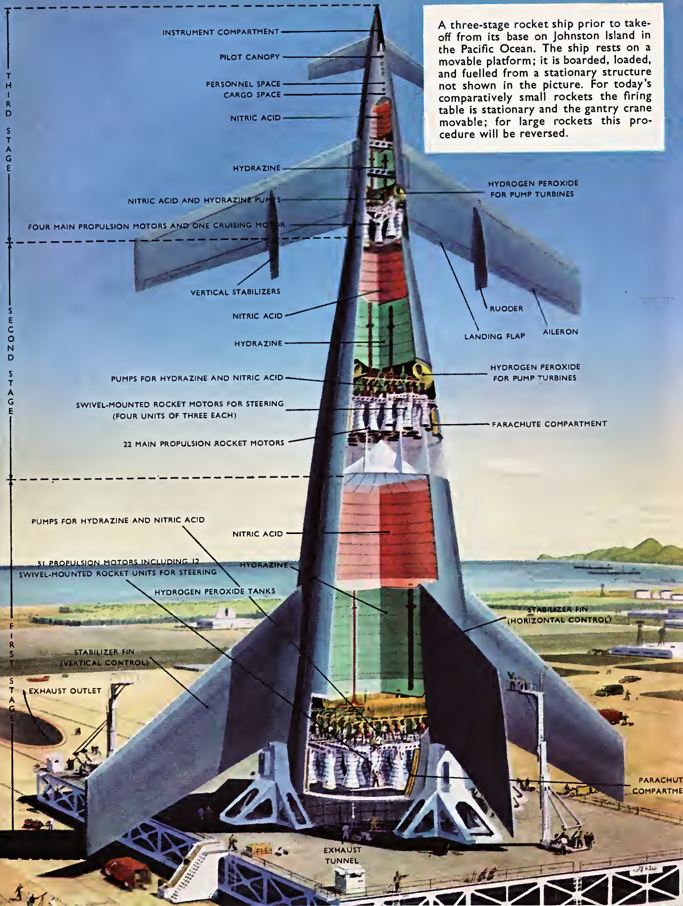





WORKING CHAMBER GYROSCOPICALLY CONTROLLED & ALWAYS UPRIGHT
CREW OF TWO MEN
MAIN GYROSCOPES
LIVING CHAMBER
MACHINERY SPACE
PARACHUTE
FUEL
FUEL
THIRD BATTERY OF REPULSE MOTORS
HEIGHT OF ROCKET 130 FEET
FUEL
FUEL
SECOND BATTERY OF REPULSE MOTORS
SELF-CONTAINED UNIT INSIDE MAIN OUTER SHELL
SLIDE
FUEL
FUEL
SLIDE
MOTOR CONTROLS
FIRST BATTERY OF REPULSE MOTORS
① THE FIRST BATTERY OF REPULSE MOTORS TO BE USED TO START THE FLIGHT OF THE ROCKET
FIN
FIN
FIN
④ FINALLY THE HEAD FLIES ON THROUGH SPACE
③ ON THE BURNING OUT OF THE 2nd BATTERY OF MOTORS, THE WHOLE LOWER PORTION IS DETACHED
HEAD
LOWER END DROPPING AWAY
EN THE 1st BATTERY REPULSE MOTORS E BURNED OUT, E MOTORS & TANKS OP AWAY INTO SPACE D ARE BLOWN TO PIECES
TANKS & MOTORS DROPPING AWAY

A three-stage rocket ship prior to take-off from its base on Johnston Island in the Pacific Ocean. The ship rests on a movable platform; it is boarded, loaded, and fuelled from a stationary structure not shown in the picture. For today's comparatively small rockets the firing table is stationary and the gantry crane movable; for large rockets this procedure will be reversed.


THIRD STAGE
INSTRUMENT COMPARTMENT
PILOT CANOPY
PERSONNEL SPACE
CARGO SPACE
NITRIC ACID
HYDRAZINE
NITRIC ACID AND HYDRAZINE PUMPS
FOUR MAIN PROPULSION MOTORS AND ONE CRUISING MOTOR
HYDROGEN PEROXIDE FOR PUMP TURBINES
SECOND STAGE
VERTICAL STABILIZERS
RUODER
AILERON
LANDING FLAP
NITRIC ACID
HYDRAZINE
PUMPS FOR HYDRAZINE AND NITRIC ACID
HYDROGEN PEROXIDE FOR PUMP TURBINES
SWIVEL-MOUNTED ROCKET MOTORS FOR STEERING (FOUR UNITS OF THREE EACH)
FARACHUTE COMPARTMENT
22 MAIN PROPULSION ROCKET MOTORS
FIRST STAGE
PUMPS FOR HYDRAZINE AND NITRIC ACID
NITRIC ACID
51 PROPULSION MOTORS INCLUDING 12 SWIVEL-MOUNTED ROCKET UNITS FOR STEERING
HYDRAZINE
HYDROGEN PEROXIDE TANKS
STABILIZER FIN (HORIZONTAL CONTROL)
STABILIZER FIN (VERTICAL CONTROL)
EXHAUST OUTLET
PARACHUT
COMPARTME
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FIRST MAN IN SPACE

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This book presents clearly and simply the American project Apollo which will culminate in the first manned landing on the moon. It looks at the geography of the moon and the theories about its formation. Going on to the early rocket experiments of Dr. Goddard, it traces the development of the science of rocketry. It describes the astronaut training programme and gives an account of the technical problems of travelling to the moon, of going into orbit round the planet and effecting a landing. The book is handsomely illustrated with full colour photographs, drawings and diagrams and features a useful dictionary of space terms.

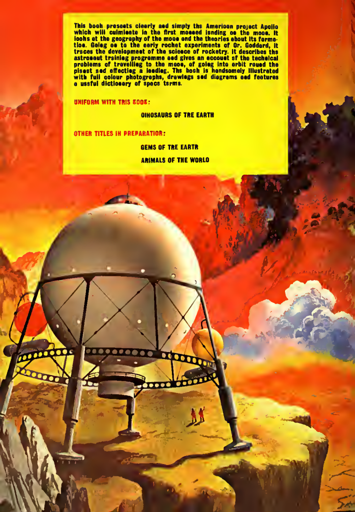
UNIFORM WITH THIS BOOK:

DINOSAURS OF THE EARTH

OTHER TITLES IN PREPARATION:

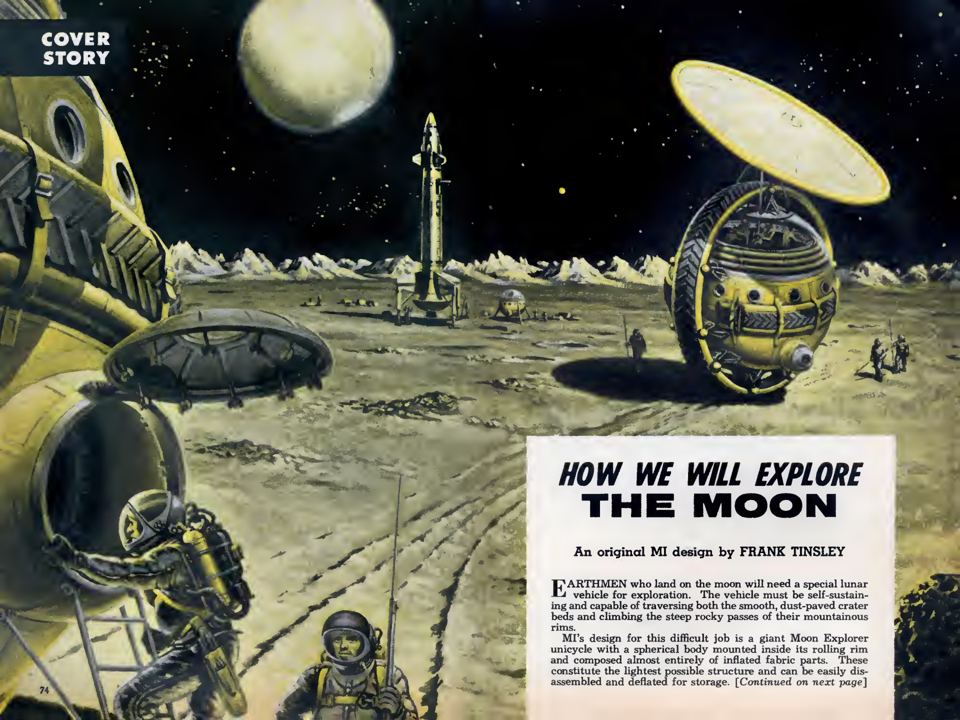
GEMS OF THE EARTH

ANIMALS OF THE WORLD



С НОВЫМ ГОДОМ!

COVER STORY

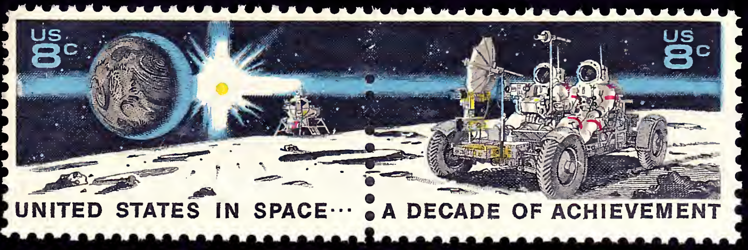


HOW WE WILL EXPLORE THE MONOON

An original MI design by FRANK TINSLEY

EARTHMEN who land on the moon will need a special lunar vehicle for exploration. The vehicle must be self-sustaining and capable of traversing both the smooth, dust-paved crater beds and climbing the steep rocky passes of their mountainous rims.

MI's design for this difficult job is a giant Moon Explorer unicycle with a spherical body mounted inside its rolling rim and composed almost entirely of inflated fabric parts. These constitute the lightest possible structure and can be easily disassembled and deflated for storage. [*Continued on next page*]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UNITED STATES IN SPACE··· A DECADE OF ACHIEVEMENT

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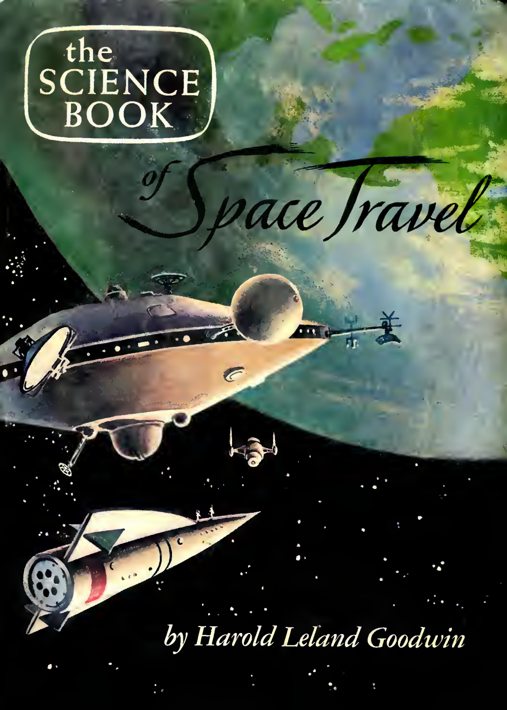
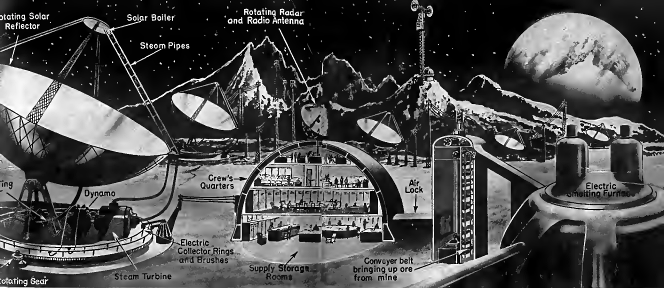
the SCIENCE BOOK of Space Travel



by Harold Leland Goodwin

ORBITING at fixed 22,000-mile altitude, four manned space stations like this one may ultimately link all of the world's major cities with live television and microwave radio communications, according to RCA engineers.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Message for Moon-Men

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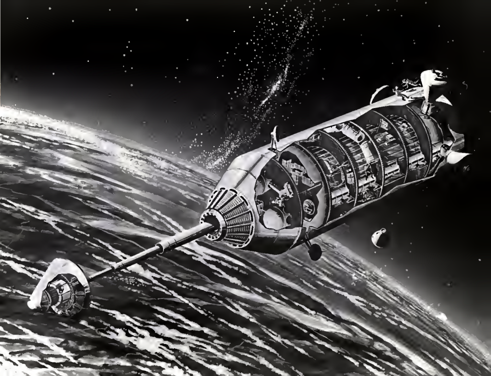
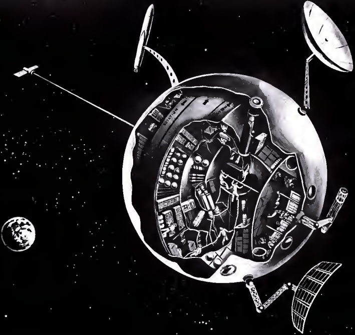
Mars, the mystery planet of sandy deserts. Careful study through telescopes indicates that some form of vegetation grows there each year, like crops do on Earth. There *may* even be animals there, with big lungs to gulp in the thin air. One day man will land there to find out!

[illegible] and Larry [illegible] on I Dream of Jeannie's [illegible] Nelson and Jeannie, [illegible]

NASA





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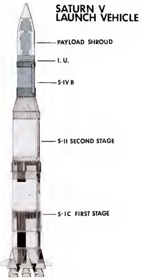
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PAYLOAD SHROUD
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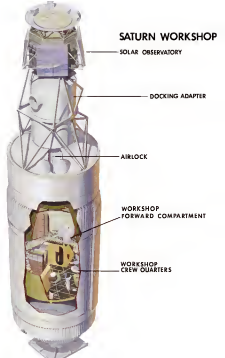
S-IV B
S-II SECOND STAGE
S-IC FIRST STAGE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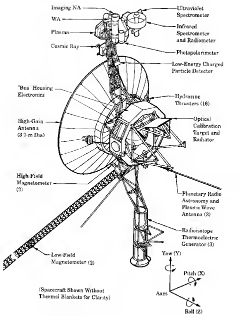
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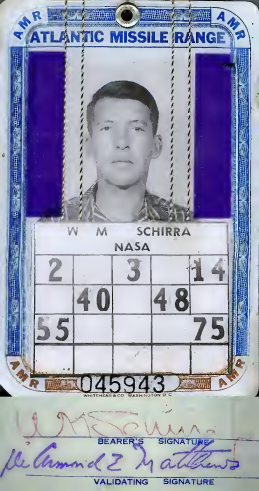
(Spacecraft Shown Without Thermal Blankets for Clarity)



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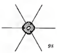
102 *Vanguard II, U.S.A., February 17, 1959*
103 *Pioneer V, U S.A., March 11, 1960*
104 *Sputnik III U.S.S.R., May 15, 1958*
105 *Transit III-B and Lofti, U.S A., February 22, 1961*
106 *Transit IV-A, Greb, and Injun, U.S.A., June 29, 1961*
107 *Explorer XI, U.S.A., April 27, 1961*
108 *Tiros III, U.S.A., July 12, 1961*
109 *Midas III, U.S.A., July 12, 1961*
110 *Ranger III, U.S.A., January 26, 1962*
111 *Orbiting Solar Observatory, U.S.A., March 7, 1962*
112 *Explorer XIII, U.S.A., August 25, 1961*
113 *Telstar I, U.S.A., July 10, 1962*
114 *Friendship 7, U.S.A., February 20, 1962*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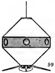
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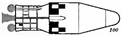
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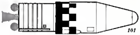
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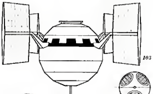
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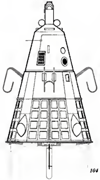
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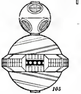
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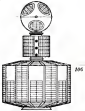
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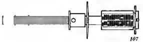
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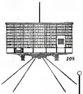
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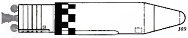
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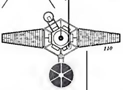
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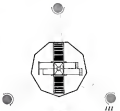
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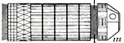
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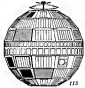
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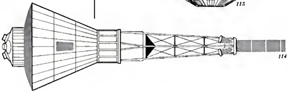
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UNITED STATES
13

President Nixon talks to the astronauts on the moon.

DECEMBER, 1968

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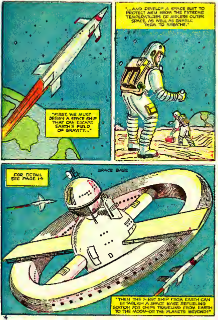
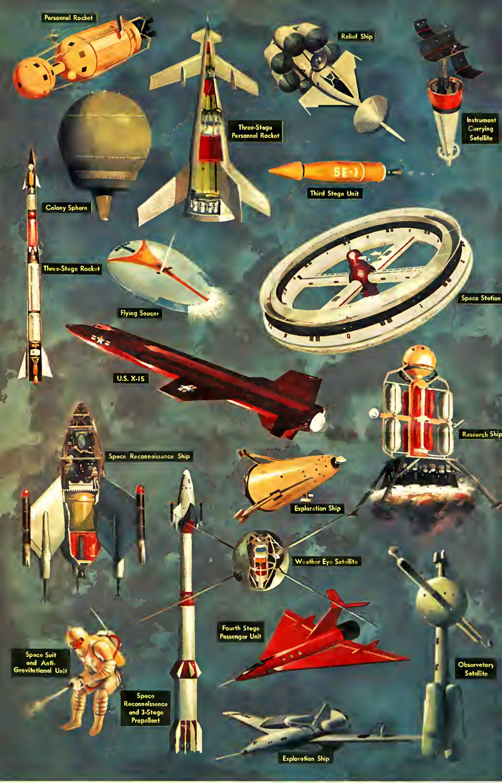

"FIRST, WE MUST DESIGN A SPACE SHIP THAT CAN ESCAPE EARTH'S FIELD OF GRAVITY..."
"...AND DEVELOP A SPACE SUIT TO PROTECT MEN FROM THE EXTREME TEMPERATURES OF AIRLESS OUTER SPACE, AS WELL AS ENABLE THEM TO BREATHE."
FOR DETAIL SEE PAGE 14
SPACE BASE
"THEN THE FIRST SHIP FROM EARTH CAN ESTABLISH A SPACE BASE REFUELING STATION FOR SHIPS TRAVELING FROM EARTH TO THE MOON—OR THE PLANETS BEYOND!"



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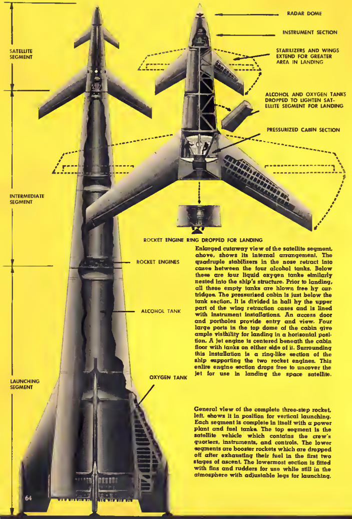
Present and Planned Satellite Gear Is Really Out of This World

By FRED DICKENSON

SO SWIFTLY are we hurtling into the space age that accomplished fact, drawing board projects and even far-out designs blend together for us in trying to keep up with science. One down-to-earth aspect, however, is that man-made articles in space, no matter how fantastic, are known by the prosaic name of "hardware". Here may be seen an artist's view of some U.S. orbiting hardware both present and contemplated. It ranges from the bullet-like Air Force X-15 (center) which has made many successful flights, to a space station (upper right) still on the draftsman's board.

Many instrument-carrying satellites such as that shown at the upper right already are in orbit, of course. And while the anti-gravitational unit (lower left) and space reconnaissance ship above it are not yet part of our equipment, few

(Continued on Page 10.)


SATELLITE SEGMENT
INTERMEDIATE SEGMENT
LAUNCHING SEGMENT
RADAR DOME
INSTRUMENT SECTION
STABILIZERS AND WINGS EXTEND FOR GREATER AREA IN LANDING
ALCOHOL AND OXYGEN TANKS DROPPED TO LIGHTEN SATELLITE SEGMENT FOR LANDING
PRESSURIZED CABIN SECTION
ROCKET ENGINE RING DROPPED FOR LANDING
ROCKET ENGINES
ALCOHOL TANK
OXYGEN TANK

Enlarged cutaway view of the satellite segment, above, shows its internal arrangement. The quadruple stabilizers in the nose retract into cases between the four alcohol tanks. Below these are four liquid oxygen tanks similarly nested into the ship's structure. Prior to landing, all these empty tanks are blown free by cartridges. The pressurised cabin is just below the tank section. It is divided in half by the upper part of the wing retraction cases and is lined with instrument installations. An access door and portholes provide entry and view. Four large ports in the top dome of the cabin give ample visibility for landing in a horisontal position. A jet engine is centered beneath the cabin floor with tanks on either side of it. Surrounding this installation is a ring-like section of the ship supporting the two rocket engines. This entire engine section drops free to uncover the jet for use in landing the space satellite.

General view of the complete three-step rocket, left, shows it in position for vertical launching. Each segment is complete in itself with a power plant and fuel tanks. The top segment is the satellite vehicle which contains the crew's quarters, instruments, and controls. The lower segments are booster rockets which are dropped off after exhausting their fuel in the first two stages of ascent. The lowermost section is fitted with fins and rudders for use while still in the atmosphere with adjustable legs for launching.

FRANK TINSLEY '51

vestigating the fantastic dreams of Sunday-supplement screwballs!

To those in the know, however, the news was no surprise. The snowballing mass of scientific data on the space around us was no great secret. The problems involved in space travel—physical, engineering and human—were being methodically tackled and licked. Rocket designers' slipsticks were getting hot. Astronomers were calculating take-off ellipses and orbits. Physicists were feeding figures into vast mechanical brains and medical specialists were busy with the human angle.

Then, under the pressure of political crises, the furor was forgotten. No further news was forthcoming and, space wise, John Q. Public went back to sleep.

However, it was a short nap. During the past year, John Q. awoke again to a realization that this space stuff was more than mere entertainment. He heard solid technical men like William B. Bergen, vice president and chief engineer of the Glen L. Martin aircraft company, predict earth satellites in ten years.

Early in September, too, *Space Medicine*, a book edited by Prof. John P. Marbarger, Director of Research in the Aeromedical and Physical Environment Laboratory, was published. This book on the medical aspects of space travel is a symposium by eminent specialists in the field, including the Surgeon General of the Air Force. It covers the physical hazards of interplanetary travel, the effects of rapid acceleration and loss of gravity, bioclimatology and the possibility of life on other planets in a scientific manner that leaves no doubt of the book's seriousness.

Then there was the meeting in London of the International Congress on Astronautics sponsored by the British Interplanetary Society. Gathered there were the world's leading rocket engineers, physicists, astronomers and space scientists. The consensus of opinion of the Congress was that a 50-ton earth satellite vehicle would be boring through space about 300 miles above the earth at a speed of 18,000 mph within a decade. In 25 years, they believe, flights to the moon may be possible.

A paper on practical interplanetary rocket design by Dr. Wernher von Braun was even more specific. Technical director of Germany's wartime rocket research station at Peenemunde, Dr. Braun is the designer of the famous V-2 and now heads Uncle Sam's secret rocket center at Fort Bliss, Tex. He believes that all the basic engineering know-how to build a chemical fuel satellite is now at hand. Given sufficient money, it could be ready to go in five years! What's more, he has a preliminary design on paper right now, in the form of a huge, three-step rocket.

This multiple-step rocket builds up, by successive increments, sufficient speed to break the grip of the earth's gravitational pull. This escape velocity is roughly 23,000 feet per second. The [*Continued on page 162*]

Stripped-down satellite comes in for a landing with fuel tanks and rocket engine ring dropped and wings extended. Excess crew and records have been parachuted to safety. With the jet engine operating and the wheels lowered for the final approach, the satellite lands as slowly and easily as a light, twin-engine transport plane.

Space Cops to Enforce
WORLD PEACE

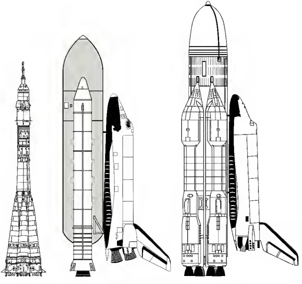
Topmost unit of the three-step rocket would be released to revolve about the earth.

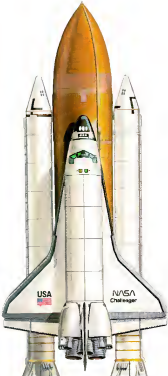
Man-made satellite rocketships may soon revolve in endless orbits around the earth, policing our civilization.

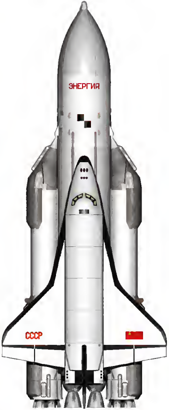
By Frank Tinsley

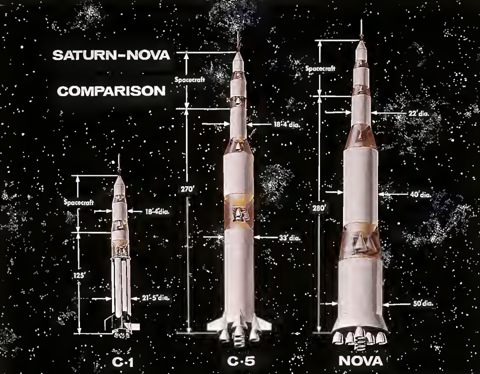
NATIONS of the world are racing to send the first man-made satellite revolving in an endless orbit around the earth. In the hands of an agressor, such a machine might mean slavery for all mankind, but as a police unit of the United Nations, it holds a promise of world peace.

Back in the closing days of 1948, when Secretary of Defense James Forrestal disclosed the existence of an "earth satellite vehicle program," the press and public reacted with a gasp of incredulous amazement. For the first time, responsible officials had dared to admit that they were seriously in-




USA
NASA
Challenger

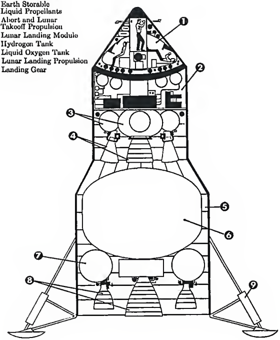

ЭНЕРГИЯ
СССР

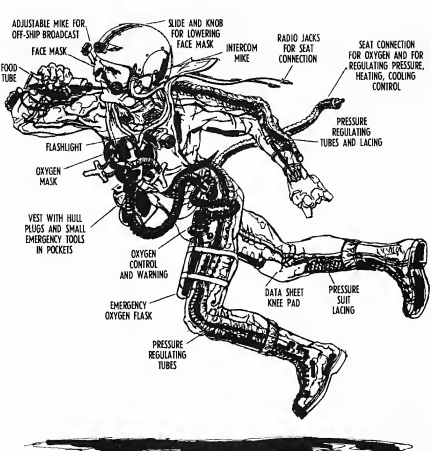


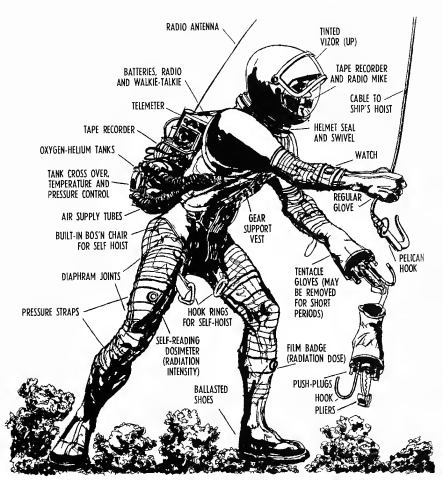
M-MS-G-36-62, Apr.11,1962

LIFE

1. Command Module
2. Equipment Storage
3. Earth Storable Liquid Propellants
4. Abort and Lunar Takeoff Propulsion
5. Lunar Landing Module
6. Hydrogen Tank
7. Liquid Oxygen Tank
8. Lunar Landing Propulsion
9. Landing Gear




ADJUSTABLE MIKE FOR OFF-SHIP BROADCAST
SLIDE AND KNOB FOR LOWERING FACE MASK
FACE MASK
INTERCOM MIKE
RADIO JACKS FOR SEAT CONNECTION
SEAT CONNECTION FOR OXYGEN AND FOR REGULATING PRESSURE, HEATING, COOLING CONTROL
FOOD TUBE
PRESSURE REGULATING TUBES AND LACING
FLASHLIGHT
OXYGEN MASK
VEST WITH HULL PLUGS AND SMALL EMERGENCY TOOLS IN POCKETS
OXYGEN CONTROL AND WARNING
DATA SHEET KNEE PAD
PRESSURE SUIT LACING
EMERGENCY OXYGEN FLASK
PRESSURE REGULATING TUBES


RADIO ANTENNA
TINTED VIZOR (UP)
BATTERIES, RADIO AND WALKIE-TALKIE
TAPE RECORDER AND RADIO MIKE
CABLE TO SHIP'S HOIST
TELEMETER
TAPE RECORDER
HELMET SEAL AND SWIVEL
OXYGEN-HELIUM TANKS
WATCH
TANK CROSS OVER, TEMPERATURE AND PRESSURE CONTROL
REGULAR GLOVE
AIR SUPPLY TUBES
GEAR SUPPORT VEST
BUILT-IN BOS'N CHAIR FOR SELF HOIST
PELICAN HOOK
TENTACLE GLOVES (MAY BE REMOVED FOR SHORT PERIODS)
DIAPHRAM JOINTS
PRESSURE STRAPS
HOOK RINGS FOR SELF-HOIST
SELF-READING DOSIMETER (RADIATION INTENSITY)
FILM BADGE (RADIATION DOSE)
PUSH-PLUGS
BALLASTED SHOES
HOOK
PLIERS

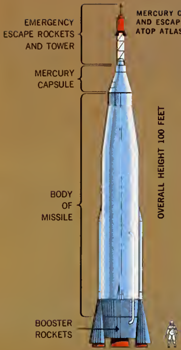
A study of the night sky with its myriads of stars can prove full of interest. If you can locate the Pole Star, you can easily check your bearings when travelling at night.

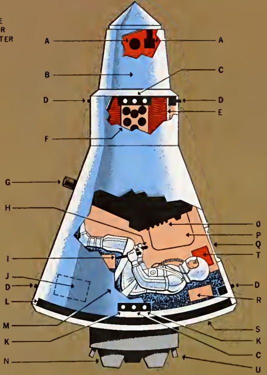
Foreword by **SCOTT CROSSFIELD**

America's First X-15 Pilot

American SPACE DIGEST

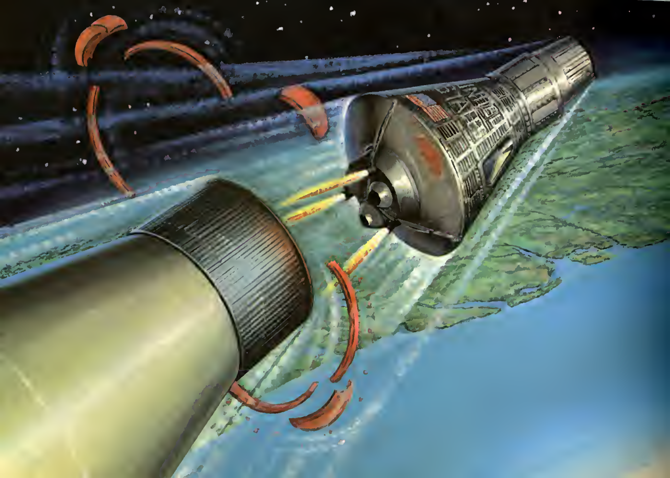
MERCURY CAPSULE AND ESCAPE TOWER ATOP ATLAS BOOSTER



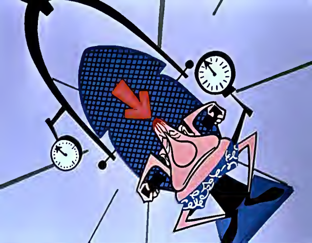


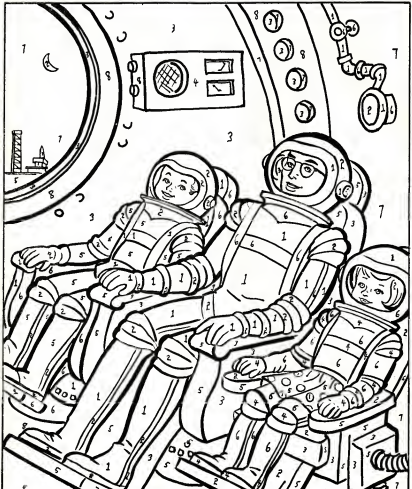
MERCURY CAPSULE

- A HORIZON SCANNER
- B ANTENNA HOUSING
- C YAW-CONTROL JETS
- D PITCH-CONTROL JETS
- E MAIN AND RESERVE CHUTES
- F RECOVERY-AID BALLOONS
- G PERISCOPE (EXTENDED)
- H ATTITUDE CONTROLLER
- I ESCAPE INITIATOR
- J ENVIRONMENTAL-CONTROL SYSTEM
- K ROLL-CONTROL JETS
- L AIR CUSHION
- M COUCH
- N RETRO-FIRING ROCKETS
- O INSTRUMENT PANEL
- P SIDE HATCH
- Q WINDOW
- R COMMUNICATIONS SYSTEM
- S HEAT SHIELD
- T CAMERAS
- U 3 FORWARD-FIRING ROCKETS (POSIGRADE) REMOVE CAPSULE FROM BOOSTER

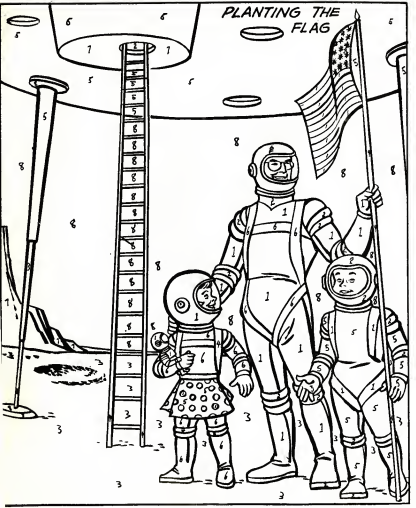


SPACE MEDICINE
NEWTON





PLANTING THE FLAG



COLOR BY NUMBER
with
A COMPLETE STORY
of

ADVENTURES IN SPACE

59c

LIFE

ALL ABOUT THE MOON

FACTS, FABLES ON WAY STATION TO SPACE

THE CHRISTMAS MIRACLE BY REMBRANDT

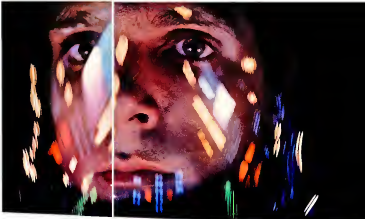
A PREHISTORIC EXPLOSION
THAT MADE A LUNAR LANDMARK

EG. U. S PAT. OFF.

DECEMBER 15, 1958 25 CENTS

LIFE
Vol. 64, No. 14
April 5, 1968

1352 B.C. Egypt's king faces eternity . . . *. . . a movie spaceman faces the year 2001 A.D.*



Fanciful Leap Across the Ages

Mankind's amazing past and amazing future are tuned in together here, as if on a time machine. From the golden mummy mask of the young Egyptian king, Tutankhamun, the ancient past looks forth confident and secure. From behind a plastic mask, a young American spaceman hurtling to Jupiter looks forth courageous but uncertain. These two speak for two separate stories in this issue: the Egypt of thousands of years ago (*pp. 42-59*) and the universe of the future foreseen in a brain-boggling new movie, *2001: A Space Odyssey* (*next 10 pages*).

Tune in the Egyptian a little more sharply and it becomes clear that, of the two, he looks more comfortable. His journeys were inward instead of outward, and these carried him toward a closer harmony with his physical world—the earth, its elements and animals. His only space trip was on a sky boat which ferried him after death to eternity, where he could still enjoy earthly pleasures. The spaceman in the movie journeys toward the frontiers of the universe. In a deathlike coma (*p. 34A*), his colleagues lie not in a mummy's tomb, but in scientific coffins to be revived when they reach some remote planet. Oddly paired and separated by centuries as they are, these two mortals, King Tut and a spaceman—both looking for fulfillment and, within the limits of their comprehension, for truth—are basically in the same sky boat.

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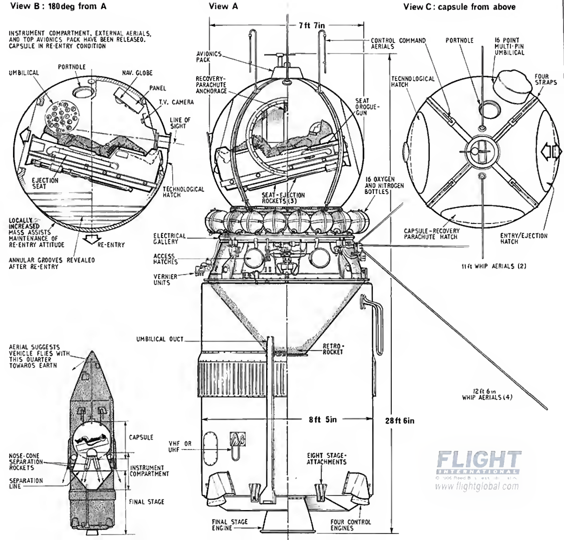
POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG'D. TRADE MARK, GREAT BRITAIN, No. [illegible] REG. U.S. PAT. OFF.

ROCKET TO THE MOON

—No longer a fantastic dream—Page 89


View B : 180deg from A
INSTRUMENT COMPARTMENT, EXTERNAL AERIALS, AND TOP AVIONICS PACK HAVE BEEN RELEASED. CAPSULE IN RE-ENTRY CONDITION
UMBILICAL
PORTHOLE
NAV. GLOBE
PANEL
T.V. CAMERA
LINE OF SIGHT
EJECTION SEAT
TECHNOLOGICAL HATCH
LOCALLY INCREASED MASS ASSISTS MAINTENANCE OF RE-ENTRY ATTITUDE
RE-ENTRY
ANNULAR GROOVES REVEALED AFTER RE-ENTRY
View A
7 ft 7in
CONTROL COMMAND AERIALS
AVIONICS PACK
RECOVERY-PARACHUTE ANCHORAGE
SEAT DROGUE-GUN
16 OXYGEN AND NITROGEN BOTTLES
SEAT-EJECTION ROCKETS (3)
ELECTRICAL GALLERY
ACCESS HATCHES
VERNIER UNITS
UMBILICAL DUCT
RETRO-ROCKET
12 ft 6 in WHIP AERIALS (4)
8 ft 5in
28 ft 6in
VHF OR UHF
EIGHT STAGE-ATTACHMENTS
FINAL STAGE ENGINE
FOUR CONTROL ENGINES
View C : capsule from above
COMMAND
PORTHOLE
16 POINT MULTI-PIN UMBILICAL
TECHNOLOGICAL HATCH
FOUR STRAPS
CAPSULE-RECOVERY PARACHUTE HATCH
ENTRY/EJECTION HATCH
11 ft WHIP AERIALS (2)
AERIAL SUGGESTS VEHICLE FLIES WITH THIS QUARTER TOWARDS EARTH
CAPSULE
NOSE-CONE SEPARATION ROCKETS
INSTRUMENT COMPARTMENT
SEPARATION LINE
FINAL STAGE

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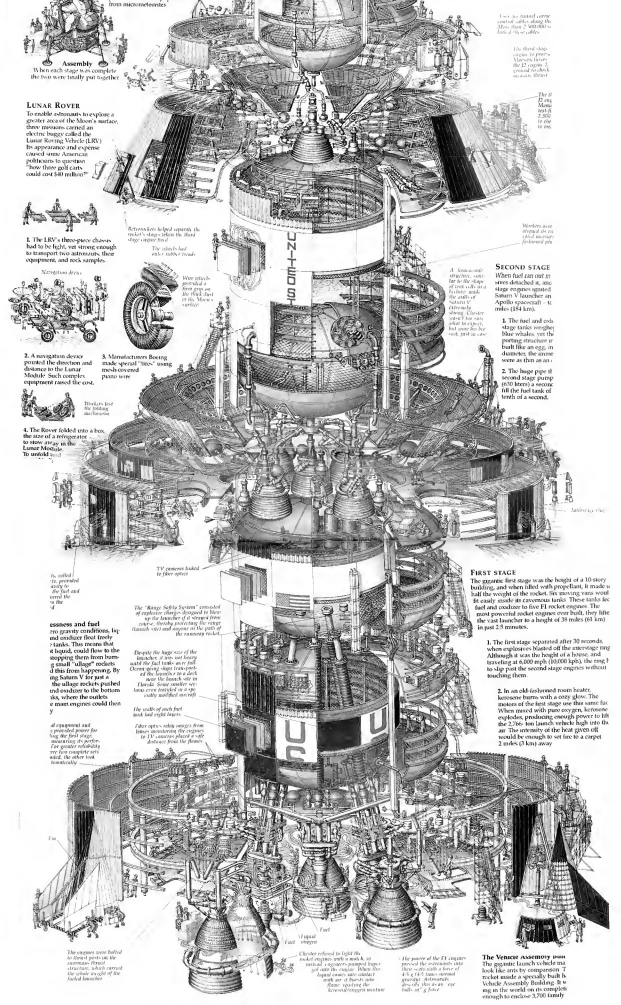
from micrometeorites



Assembly
When each stage was complete the two were finally put together

LUNAR ROVER

To enable astronauts to explore a greater area of the Moon's surface, three missions carried an electric buggy called the Lunar Roving Vehicle (LRV). Its appearance and expense caused some American politicians to question "how three golf carts could cost $40 million?"

1. The LRV's three-piece chassis had to be light, yet strong enough to transport two astronauts, their equipment, and rock samples.

2. A navigation device pointed the direction and distance to the Lunar Module. Such complex equipment raised the cost.

3. Manufacturers Boeing made special "tires" using mesh-covered piano wire

The wheels had outer rubber treads

Wire wheels provided a firm grip on the thick dust of the Moon's surface

Workers test the folding mechanism

4. The Rover folded into a box the size of a refrigerator to stow away in the Lunar Module. To unfold and

Retrorockets helped separate the rocket's stages when the third stage engine fired

A service tunnel carrie
control cables along th
More than 2 500 000 s
linked these cables

The third stage
engine to prove
Manufacturers
the J2 engine 2,
ground to check
measure thrust

The th
J2 eng
Manu
test-fi
2,500
to che
to me

Workers asse
aligned its ri
rated measur
fashioned plu

A honeycomb structure, similar to the shape of wax cells in a beehive, made the walls of Saturn V extremely strong. Chester wasn't too sure what to expect, but wore his bee suit, just in case

SECOND STAGE

When fuel ran out in
sives detached it, and
stage engines ignited
Saturn V launcher an
Apollo spacecraft – to
miles (184 km).

1. The fuel and oxi
stage tanks weighe
blue whales, yet th
porting structure ir
built like an egg, in
diameter, the imme
were as thin as an

2. The huge pipe th
second stage pump
(630 liters) a second
fill the fuel tank of
tenth of a second.

ts, called
ts, provided
avity to
the fuel and
vered the
n the
d

essness and fuel

ero gravity conditions, liq-
ind oxidizer float freely
e tanks. This means that
ot liquid, could flow to the
stopping them from burn-
g small "ullage" rockets
d this from happening. By
ing Saturn V for just a
the ullage rockets pushed
ind oxidizer to the bottom
iks, where the outlets
e main engines could then
y

al equipment and
s provided power for
ling the first stage,
measuring its perfor-
For greater reliability
ere two complete sets
iled, the other took
tomatically

The "Range Safety System" consisted of explosive charges designed to blow up the launcher if it strayed from course, thereby protecting the range (launch site) and anyone in the path of the runaway rocket.

Despite the huge size of the launcher, it was not heavy until the fuel tanks were full. Ocean-going ships transported the launcher to a dock near the launch site in Florida. Some smaller sections even traveled in a specially modified aircraft

The walls of each fuel tank had eight layers

Fiber optics relay images from lenses monitoring the engines to TV cameras placed a safe distance from the flames

FIRST STAGE

The gigantic first stage was the height of a 10-story building, and when filled with propellant, it made u
half the weight of the rocket. Six moving vans woul
fit easily inside its cavernous tanks. These tanks fec
fuel and oxidizer to five F1 rocket engines. The
most powerful rocket engines ever built, they lifte
the vast launcher to a height of 38 miles (61 km)
in just 2.5 minutes.

1. The first stage separated after 30 seconds,
when explosives blasted off the interstage ring
Although it was the height of a house, and
traveling at 6,000 mph (10,000 kph), the ring h
to slip past the second stage engines without
touching them

2. In an old-fashioned room heater,
kerosene burns with a cozy glow. The
motors of the first stage use this same fuc
When mixed with pure oxygen, kerosene
explodes, producing enough power to lift
the 2,766- ton launch vehicle high into the
air. The intensity of the heat given off
would be enough to set fire to a carpet
2 miles (3 km) away

The engines were bolted to thrust posts on the enormous thrust structure, which carried the whole weight of the fueled launcher

Chester refused to light the rocket engines with a match, so instead engineers pumped hyper gol into the engine. When this liquid comes into contact with air it bursts into flame igniting the kerosene/oxygen mixture

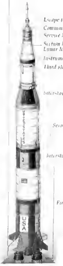
The power of the F1 engines pressed the astronauts into their seats with a force of 4.5 g (4.5 times normal gravity). Astronauts describe this as an "eye balls in" g force

The Vehicle Assembly Bui

The gigantic launch vehicle ma
look like ants by comparison. T
rocket inside a specially built h
Vehicle Assembly Building. It w
ing in the world on its complet
enough to enclose 3,700 family

SATURN V

WHEN THE AMERICAN SPACE PROGRAM FINALLY achieved a Moon landing on July 20, 1969, the Apollo 11 spacecraft was launched by a powerful rocket called Saturn V. The most powerful rocket ever, Saturn V was used to launch all the Apollo spacecraft on lunar missions. The rocket alone stood 363 feet (110 meters) high and had three stages, each of which fell away when it ran out of fuel. To follow what happened as Saturn V took off, start at the the first stage at the bottom right of the page.



ESCAPE TOWER

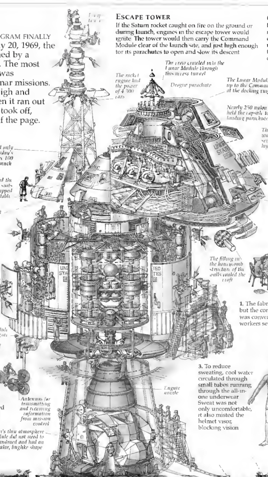
If the Saturn rocket caught on fire on the ground or during launch, engines in the escape tower would ignite The tower would then carry the Command Module clear of the launch site, and just high enough for its parachutes to open and slow its descent

COMMAND MODULE

During their journey to the M
in the Command Module Wh
descended to the lunar surface
in the orbiting craft. Building t
the most complex task of the A
over two million parts (a car h

1. The pressurize
was only a little l
car, but in this sm
had to eat, sleep,
for over a week.

2. Special shields
Command Modu
intense heat gene
Earth's atmosphe
Module fell throu
until it was 24,00
the ocean. Then s
parachutes opene
The main parach
slowing the craft
the ocean safely


The rocket engine had the power of 4 300 cars
The crew crawled into the Lunar Module through this access tunnel
Drogue parachute
The Lunar Module linked up to the Command Module at the docking ring
Nearly 250 nylon strands held the capsule to the landing parachutes.
The heat shield was made up of seven different layers.
Lunar Module pilot
The flight computer had only 32K of memory – today's home computers have 100 times as much
The Mission Commander and the other astronauts wore their suits during the launch, but later slipped into something more comfortable
Command Module pilot
Small jets were positioned all around the spacecraft Controlling the firing of these rockets enabled the astronauts to turn the craft
The filling in the honeycomb structure of the walls cooled the craft
Service Module engine
Engine nozzle
Antennas for transmitting and receiving information from mission control
In the Moon's thin atmosphere the Lunar Module did not need to be streamlined and had an angular, buglike shape

SPACE SUIT

On the Moon, Extravehic
(EMUs or space suits) pr
the vacuum of space, and
radiation, and meteors E
tailor-made EMUs: one n
training suit, and one ba

Apollo space suits ha 21 layer

1. The fabrics were high-tech, but the construction process was conventional and expert workers sewed the seams

2. The
three g
underw
suit, ar

SERVICE MOOULE

Attached to the base of the Command Module, the tubular Service Module carried supplies of fuel and oxidizer, plus water and oxygen for the crew Its rocket motor moved the spacecraft into Moon orbit, and powered it back to Earth

LUNAR MODULE

The Lunar Module was the only part of the Apollo 11 mission to land on the moon On launch, the Lunar Module was attached below the Command and Service Modules (CSM) Once out of Earth orbit, the petal-like doors protecting the Lunar Module fell away The crew then separated the CSM, turned it upside down and linked up with the exposed Lunar Module Finally, springs separated the Lunar Module from the third stage

how
ket

Small tubes were sewn into the fabric of th underwear

3. To reduce sweating, cool water circulated through small tubes running through the all-in-one underwear Sweat was not only uncomfortable, it also misted the helmet visor, blocking vision

4. Hoses a
level carri
from the
through th
Portable Life
Support System
(PLSS), which
filtered it to remove
carbon dioxide,
flatulence, and
moisture from sweat

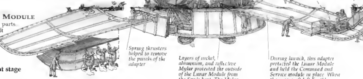
Technicians pasted a scratchy Velcro pad inside each helmet because astronauts complained that they couldn't scratch their noses

Under their suits Apollo astronauts wore diapers but hated using them
Special boots and gloves locked to the suit

5 Each of the first five EMUs cost $1 million They were constantly improved until they allowed complete freedom and were comfortable enough to wear for up to seven hours

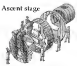
NAR MODULE

n two parts
e craft


Spring thrusters helped to remove the panels of the adapter
Layers of nickel, aluminum, and reflective Mylar protected the outside of the Lunar Module from the Sun's heat The Mylar was carefully hand crumpled before installation to improve its insulating qualities
During launch, this adapter protected the Lunar Module and held the Command and Service module in place When the spacecraft left Earth's orbit the adapter's panels opened like flower petals

escent stage

Ascent stage



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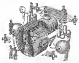
1. The ascent stage was the "cab" in which the crew would travel Engineers welded and bolted it together from carefully milled aluminum subassemblies



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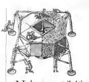
2. When the ascent stage structure was complete, assembly continued in a clean room, where engineers installed life-support, propulsion, and navigation subsystems

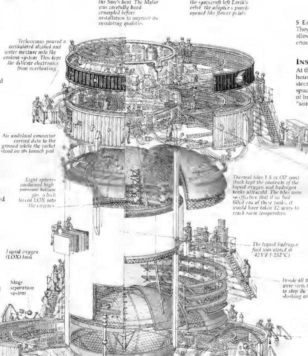


3. Technicians installed the pipework, and wrapped the descent stage in its "cooking-foil" blanket

3. A thin aluminum skin covered the protective thermal blanket of the ascent stage to protect crew and equipment from micrometeorites

INSTRUMENT UNIT

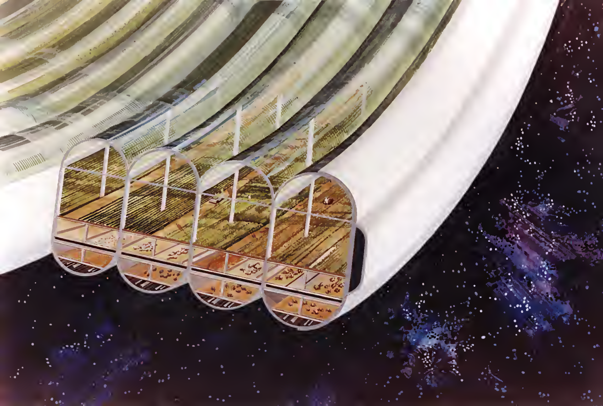
At the top of the third stage, the Instrument Unit housed the "brains" of Saturn V IBM computers steered the rocket engines, ensuring that the spacecraft traveled into the correct orbit In case of breakdown, each computer had three twin "sisters" which could take over

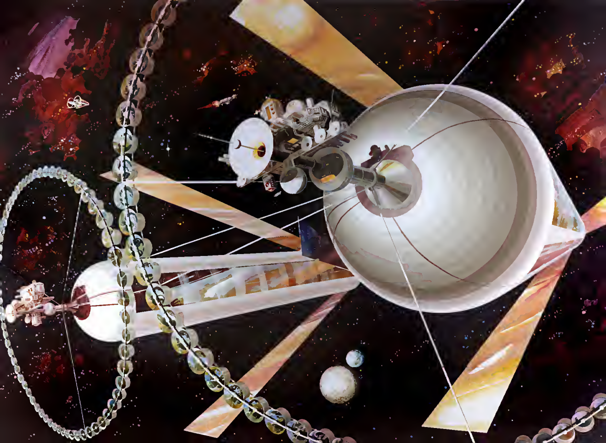

Technicians poured a methylated alcohol and water mixture into the coolant system This kept the delicate electronics from overheating
An umbilical connector carried data to the ground while the rocket stood on its launch pad
Perhaps the most important instrument was an inertial guidance system – a gyroscope that sensed the slightest movement If the launch vehicle tilted slightly, the inertial guidance system would send instructions to turn the rocket engines, steering it back on course
Eight spheres contained high pressure helium gas which forced LOX into the engines
Thermal tiles 1 5 in (37 mm) thick kept the contents of the liquid oxygen and hydrogen tanks ultracold The tiles were so effective that if we had filled one of these tanks, it would have taken 12 years to reach room temperature
Liquid oxygen (LOX) tank
The liquid hydrogen fuel was stored at 423°F (-252°C)
Stage separation system
Inside all the tanks there were structures called baffles to stop the contents from sloshing around
A service tunnel carrie control cables along th More than 2,500,000 s linked these cables.
The third stage

THIRO STAGE

The third and smallest stage of the Saturn V launcher was the only one to reach Earth's orbit After circling the Earth once or twice the astronauts fired
time to blast their cr
work complete, the
became just another

15





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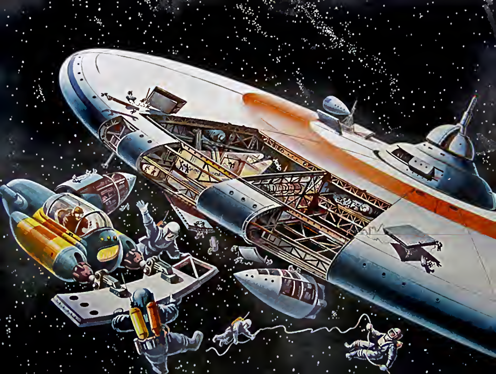
Raumgleiter – das fliegende Taxi im All

Die teuerste Sackgasse der Welt — das ist die Raumfahrt. Dollarschwere Raketenstufen fallen als Schrott in den Ozean oder verglühen in der Atmosphäre. Raumtransporter — mehrmals verwendungsfähige Zwitter aus Rakete und Flugzeug — wären eine zehnmal billigere Lösung. Mit Hilfsraketen gestartet (Bild), könnte beispielsweise eine Hälfte der Sandwich-Kombination den Aufstieg übernehmen, während das Oberteil weiterfliegt.



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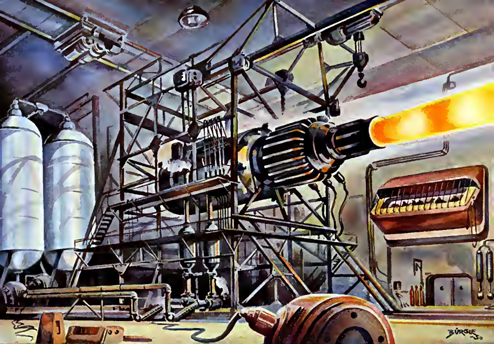
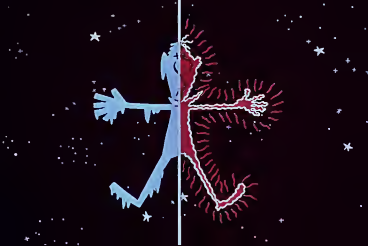
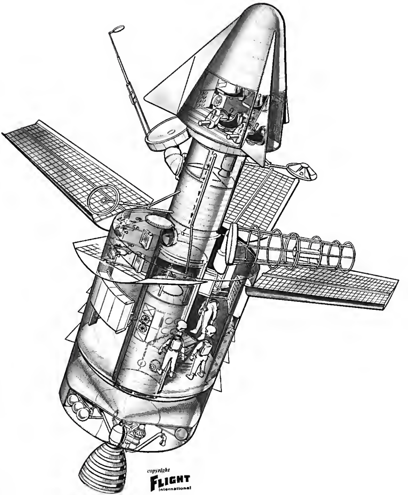

BÜRGLE

Menu





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FLIGHT
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НА ОРБИТУ ПОДВИГОВ И ОТКРЫТИЙ

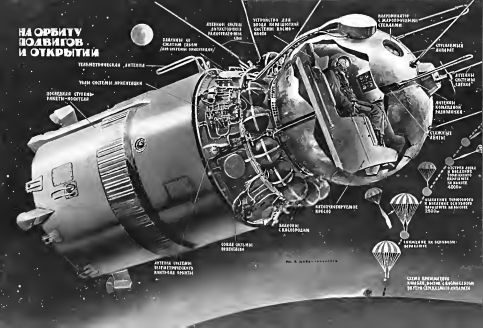

АНТЕННЫ СИСТЕМЫ ДВУХСТОРОННЕЙ РАДИОТЕЛЕФОННОЙ СВЯЗИ
УСТРОЙСТВО ДЛЯ ВВОДА ПАРАШЮТНОЙ СИСТЕМЫ КОСМОНАВТА
ИЛЛЮМИНАТОР С ЖАРОПРОЧНЫМИ СТЕКЛАМИ
БАЛЛОНЫ СО СЖАТЫМ ГАЗОМ /ДЛЯ СИСТЕМЫ ОРИЕНТАЦИИ/
ТЕЛЕМЕТРИЧЕСКАЯ АНТЕННА
УЗЛЫ СИСТЕМЫ ОРИЕНТАЦИИ
ПОСЛЕДНЯЯ СТУПЕНЬ РАКЕТЫ-НОСИТЕЛЯ
СПУСКАЕМЫЙ АППАРАТ
АНТЕННЫ СИСТЕМЫ „СИГНАЛ"
АНТЕННЫ КОМАНДНОЙ РАДИОЛИНИИ
СТЯЖНЫЕ ЛЕНТЫ
ОТСТРЕЛ ЛЮКА И ВВЕДЕНИЕ ТОРМОЗНОГО ПАРАШЮТА НА ВЫСОТЕ 4000 м
КАТАПУЛЬТИРУЕМОЕ КРЕСЛО
ОТДЕЛЕНИЕ ТОРМОЗНОГО И ВВЕДЕНИЕ ОСНОВНОГО ПАРАШЮТА НА ВЫСОТЕ 2500 м
БАЛЛОНЫ С КИСЛОРОДОМ
СНИЖЕНИЕ НА ОСНОВНОМ ПАРАШЮТЕ
СОПЛА СИСТЕМЫ ОРИЕНТАЦИИ
АНТЕННА СИСТЕМЫ ТЕЛЕМЕТРИЧЕСКОГО КОНТРОЛЯ ОРБИТЫ
СХЕМА ПРИЗЕМЛЕНИЯ КОРАБЛЯ „ВОСТОК" С КОСМОНАВТОМ ВНУТРИ СПУСКАЕМОГО АППАРАТА

Рис. Б. [illegible]

ALL ABOARD FOR OUTER SPACE!

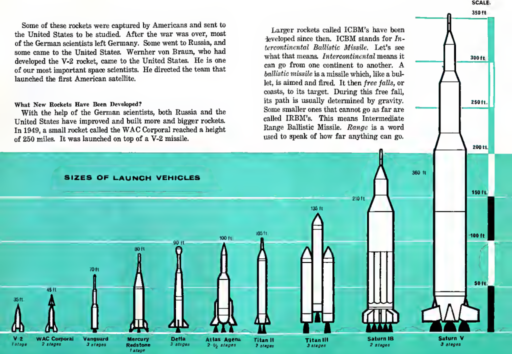
Is this the ship that will take us to earth's first manned satellite?

Some of these rockets were captured by Americans and sent to the United States to be studied. After the war was over, most of the German scientists left Germany. Some went to Russia, and some came to the United States. Wernher von Braun, who had developed the V-2 rocket, came to the United States. He is one of our most important space scientists. He directed the team that launched the first American satellite.

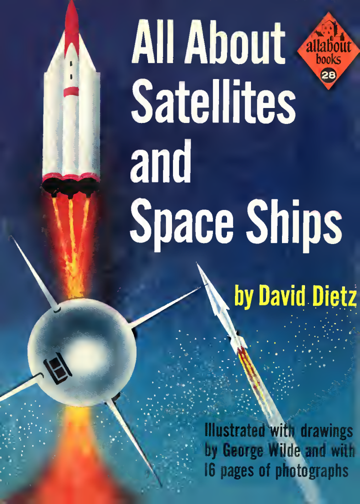
What New Rockets Have Been Developed?

With the help of the German scientists, both Russia and the United States have improved and built more and bigger rockets. In 1949, a small rocket called the WAC Corporal reached a height of 250 miles. It was launched on top of a V-2 missile.

Larger rockets called ICBM's have been developed since then. ICBM stands for *Intercontinental Ballistic Missile.* Let's see what that means. *Intercontinental* means it can go from one continent to another. A *ballistic missile* is a missile which, like a bullet, is aimed and fired. It then *free falls,* or coasts, to its target. During this free fall, its path is usually determined by gravity. Some smaller ones that cannot go as far are called IRBM's. This means Intermediate Range Ballistic Missile. *Range* is a word used to speak of how far anything can go.



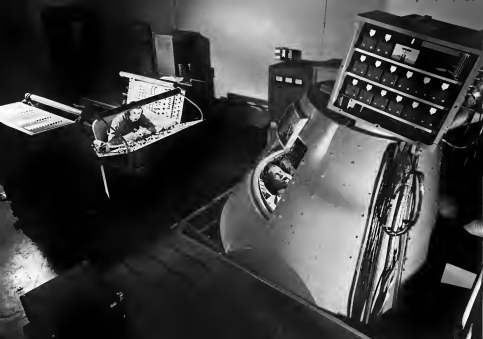
SIZES OF LAUNCH VEHICLES

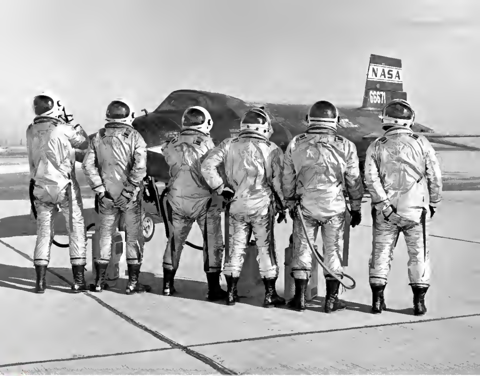


All About Satellites and Space Ships

by David Dietz

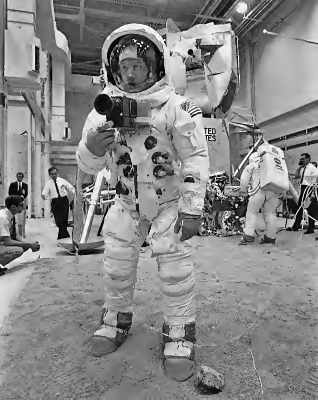
Illustrated with drawings
by George Wilde and with
16 pages of photographs





NASA Dryden Flight Research Center Photo Collection
http://www dfrc.nasa.gov/Gallery/Photo/index.html
NASA Photo: E-14182 Date: 1966

X-15 test pilots – in a lighter mood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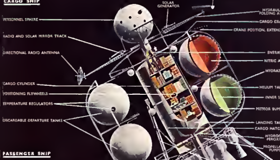
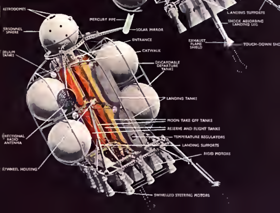
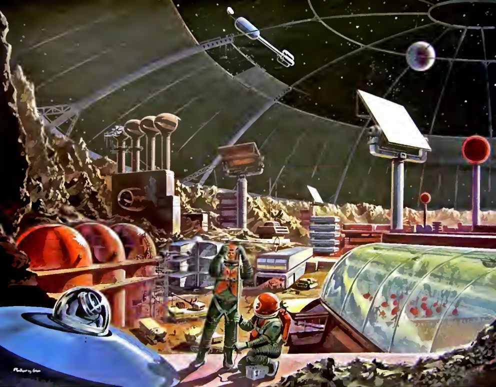
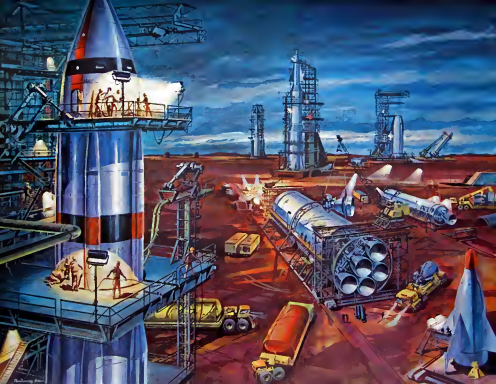
CARGO SHIP



PASSENGER SHIP



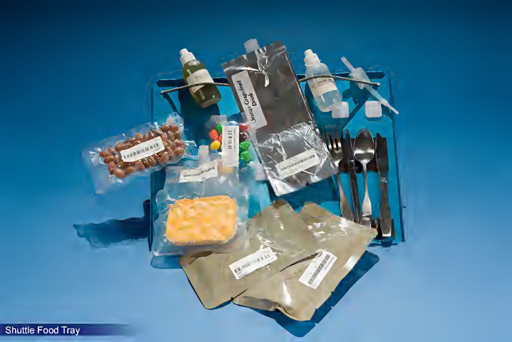




Centuri

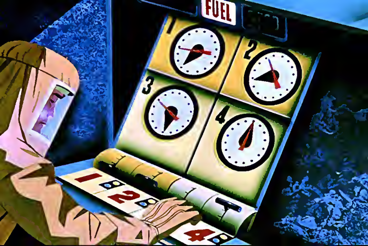
1969 MODEL ROCKET products CATALOG

1/100th Scale Model Saturn 5 rocket (see page 15 inside)



Shuttle Food Tray

UNITED
STATES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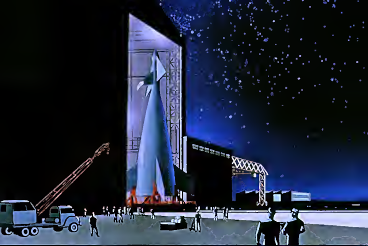


US 5c
US 5c

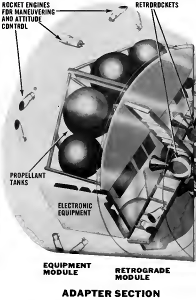
Gemini pilots have to fly the ship—it can't be controlled from the ground

their cabin, open its hinged hatches, and take turns floating about on tethers, as future astronauts must be able to do if they are to make repairs en route or build space stations in orbit.

All these demanding and perilous maneuvers must be tried out and perfected before the first manned journey to the moon can be undertaken with confidence.

Gemini's first flight. The more dramatic events will not take place on the first flight. It will be simply a three-orbit journey, lasting about four hours and a half. But in that brief time, Astronauts Virgil I. (Gus) Grissom and John W. Young will use as much as possible of the complicated equipment.

Mercury, in which all essential systems shared the cabin with its sole occupant, was as uncomfortable as a crowded broom closet. On Gemini, everything that can be put out of the astronauts' way has been stowed elsewhere. This was achieved partly by packaging the systems, partly by housing them in the outer section of a doubly constructed re-entry module, and partly by locating them in the adapter section, at the base of the spacecraft.



The crew's pressurized cabin forms the core of the re-entry module. The space between it and the outer shell is filled with instrument packages, electronics gear, and landing gear. This arrangement provides greater protection from micrometeorite damage, as well as greater comfort, than Mercury afforded. Retrorockets, fuel for positioning thrusters, batteries, and the main oxygen supply occupy the adapter section, shed before Gemini returns to the earth's atmosphere.

Mercury's capsule was launched with an escape tower attached, which would have rocketed the entire module out of harm's way if the launching rocket had misfired. Gemini provides its pilot-commander with gauges that tell him precisely how its Titan II booster is behaving. If he reads trouble on the dials, he'll pull a ring beside one knee and catapult both himself and his copilot out of the module in rocket-fired ejection seats. There's a ring at each seat, and pulling either one ejects both seats. This could be done, if necessary, during re-entry as well as during launch.

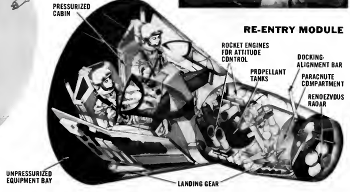
Mercury had a small reaction-control system that let its astronaut change the attitude of his craft in space, but not its orbit.

Gemini will be able to move forward and backward in any direction, up and down, and sideways. Thrust for these moves will come from a range of impulses, provided by a hypergolic mix of monomethyl hydrazine and nitrogen tetroxide.

Despite its maneuverability, piloting Gemini will not be much like driving a car. When it changes speed, it also changes the shape of its orbit, and thus its altitude.

Astronaut Young tries out left-hand attitude-control stick in one of many flight simulations.

Cutaway shows major components of Gemini capsule. Before re-entry, equipment module (needed only during orbit) breaks away, retrorockets fire, retrograde module cuts loose.



Whereas Mercury could be under completely automatic control, either from the ground or from on-board gyros, Gemini is almost entirely under control of the men aboard. It cannot be commanded from the ground. The pilot—or, if he's incapacitated, the copilot—must initiate an emergency exit, if needed, and also must trigger the re-entry system.

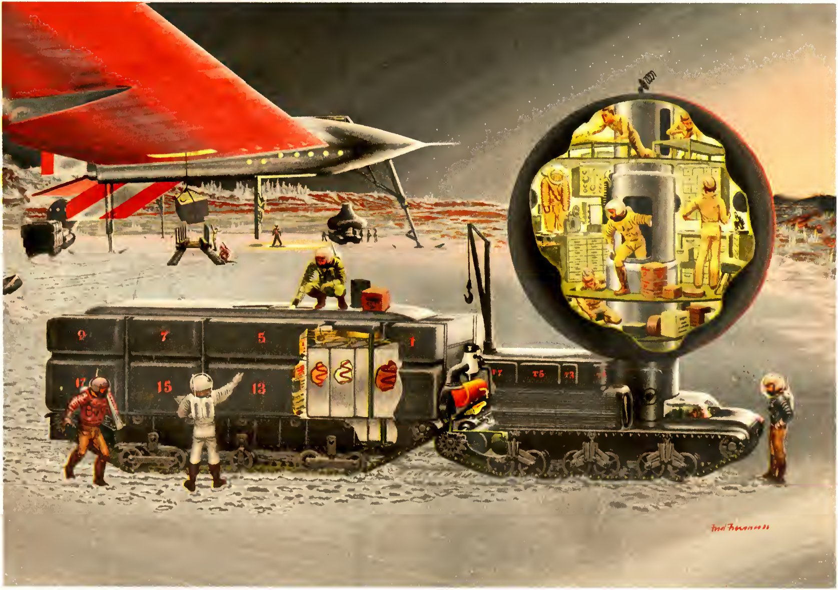
Docking. Gemini has a radar, with a 250-mile range; an inertial-guidance platform; and a manual-feed electronic computer, weighing only 57.6 pounds and taking up one cubic foot. Mercury had none of these, and had no need for them. They are essential, however, to Gemini's forthcoming tasks of meeting another spacecraft in orbit and docking with it.

This delicate and difficult job of closing on another vehicle in space when both are going 18,000 m.p.h. can be done automatically if the Gemini pilot chooses, or semiautomatically, or under the pilot's own control.

He needs to know the speed, distance, and direction that will take him to his target. Once the Gemini spacecraft is within 250 miles of the Agena D, its inertial-guidance platform and computer can get this essential information from the radar and guide the craft toward its target without help from the pilot. But if he prefers, the computer will provide him with a readout of the necessary data and he can act on it himself. In the last few feet before docking, the pilot will probably rely wholly on his own vision, judgment, and manual control.

Docking will involve a speed differential of only about 1½ m.p.h. between

[*Continued on page 201*]



FRED FREEMAN

Advance party, after landing on Martian snow in ski-equipped plane, prepares for trip to equator. Men live in inflatable, pressurized spheres mounted on tractors, enter and leave through air locks in the central column. Sphere on tractor at rear center is just being blown up. Cutaway of tractor, foreground, shows closed-circuit engine, run by hydrogen peroxide, oil. Trailer cutaway shows fuel supply, cargo

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Fred Freeman

This is how American space pioneers will land on the moon and return to earth

Countdown. Atop the 30 story Saturn V rocket three U. S. astronauts in Apollo command module prepare to be launched by 7 500 000 pounds of thrust In 70 hours—the moon

Ignition, stage two At 200 000 feet a brief jolt signals jettison of the first stage of Saturn rocket Now the S II second stage thrusts them ahead through the thin upper atmosphere

Earth orbit The S II is left behind The exhilaration of weightlessness begins as stage three powers them in to orbit At proper moment, stage three re ignites Next stop moon

Docking maneuver. On their way they detach Apollo spacecraft, turn it to dock its air lock with the waiting Lunar Excursion Module (LEM) Saturn stage three is then jettisoned

Lunar orbit. The moon draws incredibly near Two astronauts enter the LEM Apollo s service module engine slows them into lunar orbit They peer at the surface 80 miles below

Touchdown. The moment arrives Separated from the Apollo LEM descends to the moon s surface Soon these space pioneers may discover answers to questions as old as man

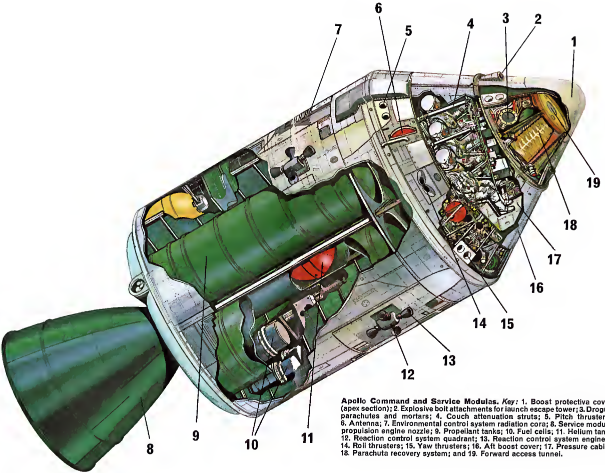
Homeward bound Their observations are complete They return in LEM to the Apollo again fire service module engine Returning to Earth will take three days The LEM stays behind

Safe landing The atmosphere slows them Three main chutes deploy Mission ends with safe ocean landing America reaps new knowledge important new space capabilities

The Apollo command module, service module, and the Saturn S-II stage are being built for NASA by North American/Space & Information Systems Division. North American Rocketdyne is building the rocket engines for all three stages of the Saturn V moon rocket.

North American Aviation

Atomics International, Autonetics Columbus, Los Angeles Rocketdyne Science Center Space & Information Systems



Apollo Command and Service Modules. *Key:* 1. Boost protective cover (apex section); 2. Explosive bolt attachments for launch escape tower; 3. Drogue parachutes and mortars; 4. Couch attenuation struts; 5. Pitch thrusters; 6. Antenna; 7. Environmental control system radiation core; 8. Service module propulsion engine nozzle; 9. Propellant tanks; 10. Fuel cells; 11. Helium tank; 12. Reaction control system quadrant; 13. Reaction control system engines; 14. Roll thrusters; 15. Yaw thrusters; 16. Aft boost cover; 17. Pressure cabin; 18. Parachute recovery system; and 19. Forward access tunnel.

WE CAME IN PEACE FOR ALL MANKIND

A recorded history
of space exploration
and the triumph
of the lunar landing

STEREO
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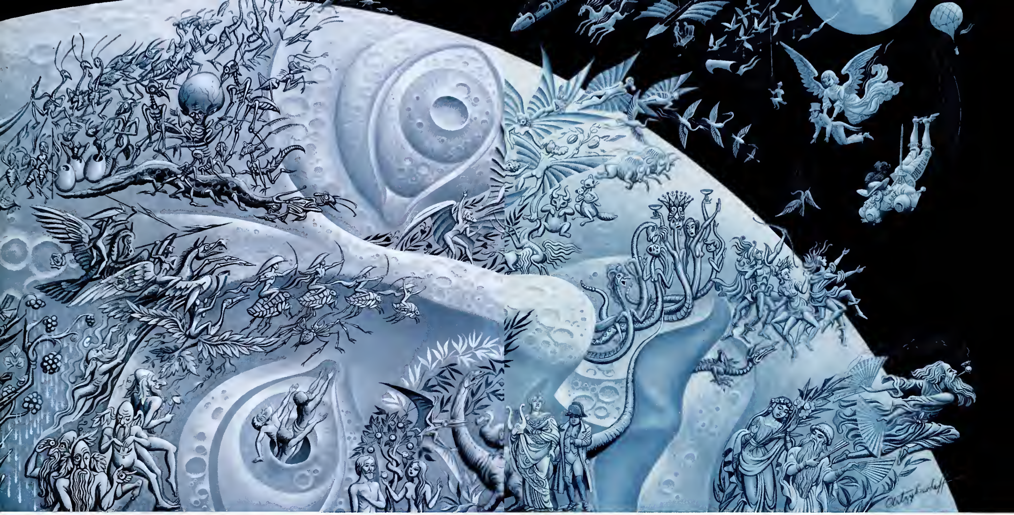

FABLED VOYAGES, BIZARRE FINDINGS OF LUNAR FICTION

The lunar journey which scientists are now attempting has been anticipated for ages by imaginative writers who have dreamed up bizarre ways to reach the moon and have populated the crater-pocked face of the Man in the Moon with a variety of fantastic creatures. A sampling of them is shown in this fanciful drawing by Boris Artzybasheff.

In the Second Century A.D., the Greek satirist Lucian of Samosata invented bald, bearded moon people (*lower left*) with stomach pouches and removable eyes. Their airborne cavalry flew into battle wearing giant pea pods for helmets. Next right, emerging from the crater which forms the Man in the Moon's right eye, are cave-dwelling sun worshipers dreamed up by Robert Paltock, an English lawyer, in 1751. To their right is a motley lineup of former Earth residents—Adam and Eve, Nero, Napoleon and extinct animals—inspired by Ariosto's account in *Orlando Furioso* (1532) of beings who disappeared from Earth and showed up on the moon.

At lower right are moon characters out of British Bishop Francis Godwin's *The Man in the Moone* (1638). They got around by leaping up and fanning themselves along. Above them are four-legged folk created by Cyrano de Bergerac (1659). They shot birds by a method which simultaneously killed, plucked, roasted and seasoned them. To their left are English-speaking serpents, the creation of an unknown writer with the pen name Aratus (1793).

Above the serpent people are weird beasts and tiny, big-winged people which the New York *Sun* reported in 1835 were seen through a giant telescope. The hoax was widely believed at the time. The grotesque insectlike creatures at upper left are out of H. G. Wells's *First Men in the Moon* (1901).

In the sky at upper right are vehicles used by science-fiction moon voyagers. They are, from left: Jules Verne's trainlike rocket (1870), which circled moon but did not land; the flaming horses which drew the chariot of Ariosto's hero, Orlando; the hand-operated flying machine in which Paltock's heroes accidentally fell to the moon; Bishop Godwin's space raft, borne by swanlike "gansas" and guided by a sail; the angel that carried the hero of George Fowler's *A Flight to the Moon* (1813); bottles of dew, which, as their contents were sucked up by the sun, carried Cyrano de Bergerac moonward. At extreme upper right is the balloon which took Aratus' hero to the moon in exactly 17 days, six hours, two minutes, three seconds.

COPYWRITTEN MATERIAL

CONTINUED

BEYOND is....what?

Sailors for centuries have set the courses of ships by stars seen with the naked eye. Extending vision with powerful telescopes, Science has found in the sky facts of practical use in measuring time, in aviation, in radio. Science learned of the existence of helium...on the sun...before military balloonists knew so safe a gas could be found in Texas.

After eleven years of toil and the expenditure of millions of dollars, there is nearing completion at the Palomar Observatory in California a telescope with a mirror 16⅔ feet in diameter. It will have an optical range of *one billion light years!* When astronomers look into the reaches of outer space through a telescope twice the size of the largest now in operation, what secrets will be revealed? The world will probably benefit by the answer to that question.

As with ventures for profit, altruistic projects like this observatory are supported by funds contributed by men who have faith in their ultimate fruitfulness. It is an axiom that such funds come forward only on the implied assurance that they will not be sacrificed to fire, windstorm, explosion or accident. Thus, the forward march of human progress moves as a convoy under the protection of property insurance. And that is the story of America's development since the first term of President Washington, when Insurance Company of North America introduced to this continent the kind of insurance known today as "Standard protection"... Its promise to pay is guaranteed through capital advanced by stockholders.

As the country grew and inventive genius added complexity to American life, this Company pioneered in developing ways to apply dependable insurance to the changed needs of property-owners. Today this oldest American fire and marine insurance company and its affiliates are organized to meet every insurance need except life.

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North America Agents are listed in Classified Telephone Directories under the name and "Eagle" emblem of Insurance Company of North America, Philadelphia. Capital: $12,000,000. Losses Paid: Over $457,000,000. Founded 1792.

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2. FLOSS AND BRUSH YOUR TEETH EVERY DAY AND
3. VISIT YOUR DENTIST OFTEN... DENTAL DISEASE WON'T HAVE A GHOST OF A CHANCE TO GET YOU!

YOUR DENTIST IS YOUR FRIEND!

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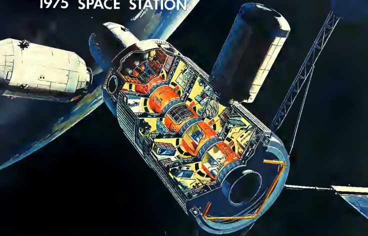
FUNTIME BOOKS

1975 SPACE STATION



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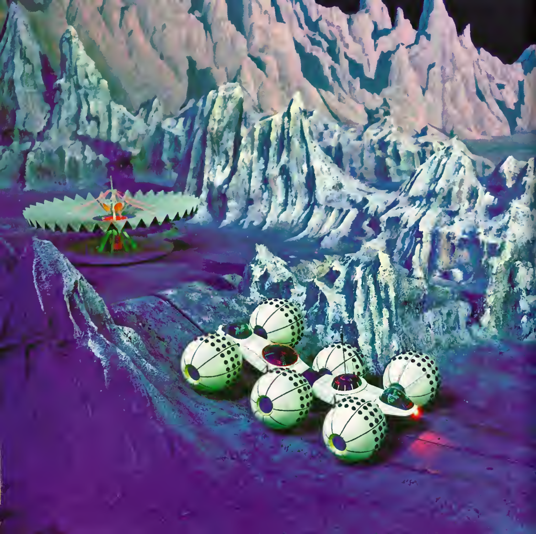
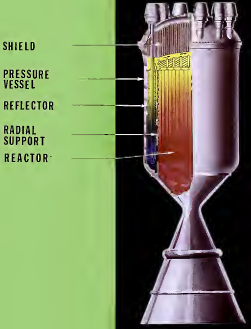
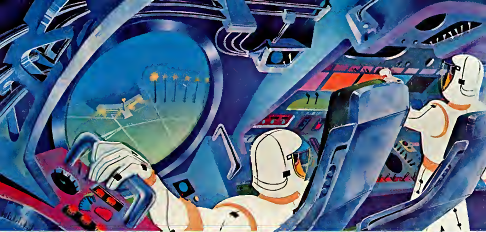


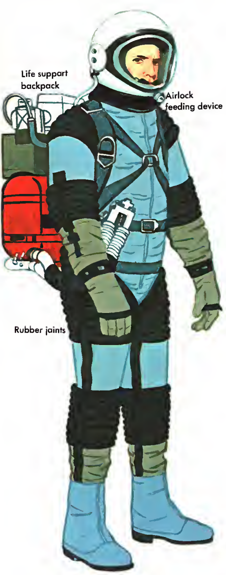


NERVA REACTOR
BASED ON NRX A1

GRAPHITE FELT LATERAL SUPPORT
TOP LOADED CORE

M-MS-G 56-3-62 REV A MAY 20, 1963




Life support backpack
Airlock feeding device
Rubber joints

UNITED

GREENWICH MEAN TIME
ORBIT NUMBER
HOLD
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ELAPSED TIME
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TIME TO RETROFIRE
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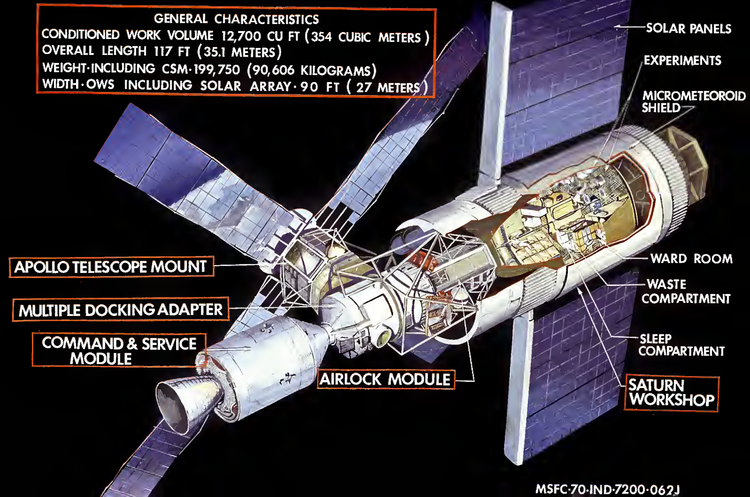
SKYLAB CLUSTER



GENERAL CHARACTERISTICS

CONDITIONED WORK VOLUME 12,700 CU FT (354 CUBIC METERS)

OVERALL LENGTH 117 FT (35.1 METERS)

WEIGHT·INCLUDING CSM·199,750 (90,606 KILOGRAMS)

WIDTH·OWS INCLUDING SOLAR ARRAY·90 FT (27 METERS)

MSFC·70·IND·7200·062J

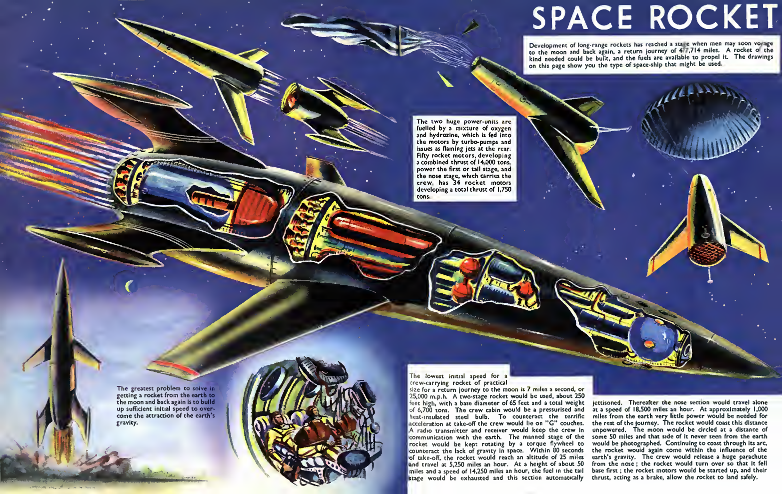
LIFE

UNITED STATES OF AMERICA

СССР

SPACE ROCKET

Development of long-range rockets has reached a stage when men may soon voyage to the moon and back again, a return journey of 477,714 miles. A rocket of the kind needed could be built, and the fuels are available to propel it. The drawings on this page show you the type of space-ship that might be used.



The two huge power-units are fuelled by a mixture of oxygen and hydrozine, which is fed into the motors by turbo-pumps and issues as flaming jets at the rear. Fifty rocket motors, developing a combined thrust of 14,000 tons, power the first or tail stage, and the nose stage, which carries the crew, has 34 rocket motors developing a total thrust of 1,750 tons.

The greatest problem to solve in getting a rocket from the earth to the moon and back again is to build up sufficient initial speed to overcome the attraction of the earth's gravity.

The lowest initial speed for a crew-carrying rocket of practical size for a return journey to the moon is 7 miles a second, or 25,000 m.p.h. A two-stage rocket would be used, about 250 feet high, with a base diameter of 65 feet and a total weight of 6,700 tons. The crew cabin would be a pressurised and heat-insulated steel bulb. To counteract the terrific acceleration at take-off the crew would lie on "G" couches. A radio transmitter and receiver would keep the crew in communication with the earth. The manned stage of the rocket would be kept rotating by a torque flywheel to counteract the lack of gravity in space. Within 80 seconds of take-off, the rocket would reach an altitude of 25 miles and travel at 5,250 miles an hour. At a height of about 50 miles and a speed of 14,250 miles an hour, the fuel in the tail stage would be exhausted and this section automatically jettisoned. Thereafter the nose section would travel alone at a speed of 18,500 miles an hour. At approximately 1,000 miles from the earth very little power would be needed for the rest of the journey. The rocket would coast this distance unpowered. The moon would be circled at a distance of some 50 miles and that side of it never seen from the earth would be photographed. Continuing to coast through its arc, the rocket would again come within the influence of the earth's gravity. The crew would release a huge parachute from the nose; the rocket would turn over so that it fell base first; the rocket motors would be started up, and their thrust, acting as a brake, allow the rocket to land safely.

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Tom Corbett's WONDER BOOK OF SPACE

WONDER BOOKS

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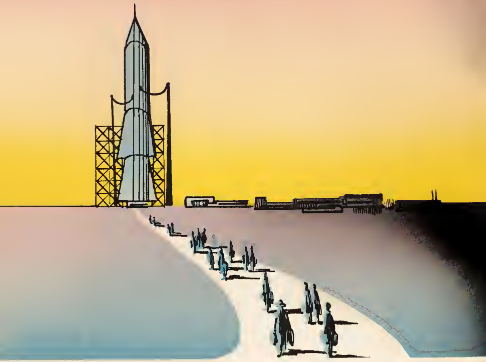
JOURNEY INTO SPACE



by Matthew F. Vessel
and Herbert H. Wong

FEARON SCIENCE EDUCATION SERIES

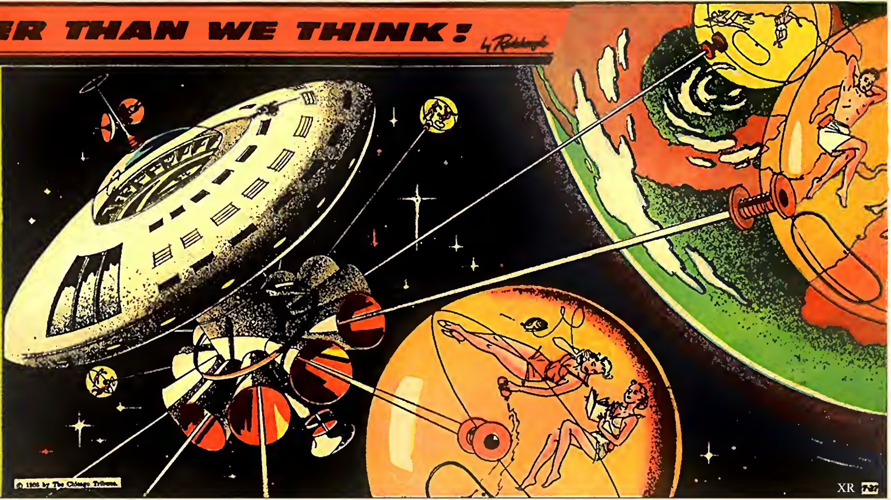
--- CLOSER THAN WE THINK!

by Radebaugh

HOSPITALS IN THE SKY!

The American Rocket Society has reported to President Eisenhower that practical medical science could benefit importantly from the weightlessness, irradiation and low temperatures of outer space. So we may find that some of tomorrow's hospitals may actually be anchored in the heavens.

One of these hospitals might be shaped like a disc atop elevator tubes leading to the control section. The mushroom-like disc would contain weightless operating rooms for treating heart and other organic troubles as well as bone diseases. It would also serve as a nucleus for crystal balls which, orbiting slowly, would utilise concentrated sunrays to treat cancer, skin diseases and similar ailments. There would also be experimental areas for the study of low temperature therapy—a challenging new field for medical investigation.



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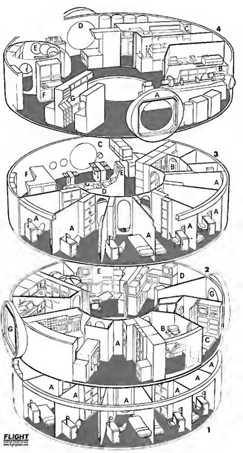

FLIGHT
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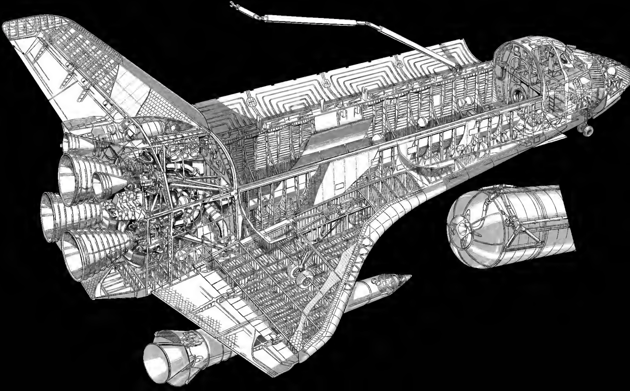
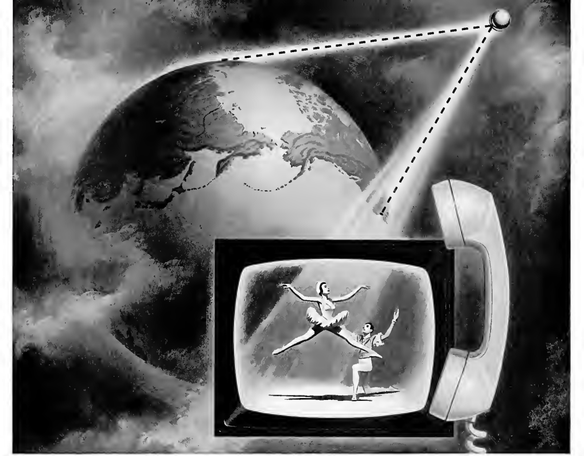




The high frequency radio waves that carry telephone and television signals travel in straight lines and refuse to follow the earth's curvature. To overcome this, it may well be possible and practical to send them over long distances by using earth satellites as relay points.

Telephone Calls and TV Shows by Way of Outer Space?

Under construction in foreground is a new antenna which Bell scientists hope will receive signals reflected from earth satellites during forthcoming tests. Background: a Project Echo transmitting antenna.

Maybe some day you'll get phone calls from Brisbane or Bombay—live TV from Caracas or Copenhagen—via satellites!

Over the years imaginative research has vastly improved your Bell Telephone service.

And right now, Bell scientists are looking ahead to an extraordinary possibility: the sending of telephone calls and TV shows across oceans via earth satellites. Such an idea—until recently only dreamed of—may now be within man's reach.

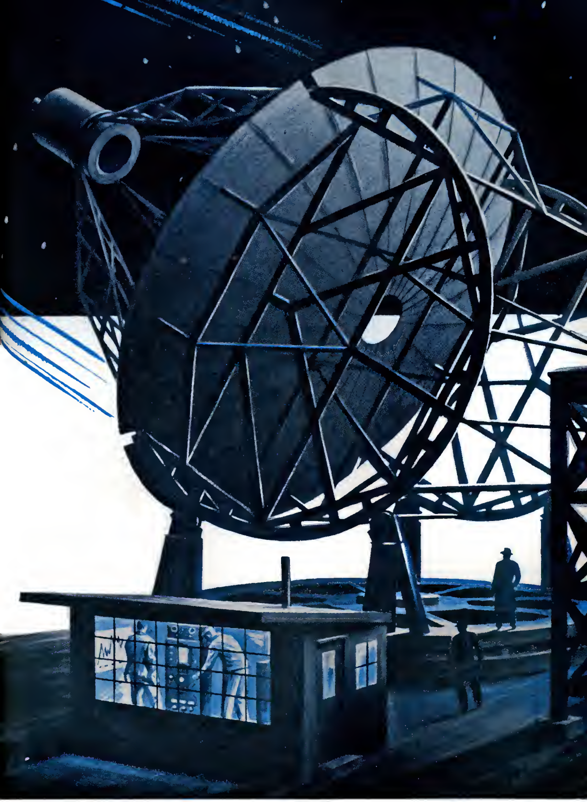
Relaying signals between two places on earth from objects orbiting in space may prove to be a practical—and economical—means of communication in the future. For it would permit sending TV programs and many phone calls simultaneously across the widest oceans.

To explore the possibilities of this type of global communication, scientists and engineers at Bell Telephone Laboratories are now working hard on the communication phase of Project Echo. This experiment, sponsored by the National Aeronautics and Space Administration, seeks to reflect radio and voice signals across the United States by means of a 100-foot satellite.

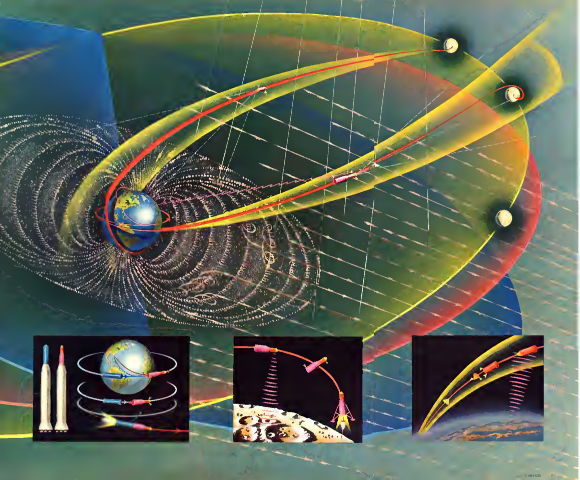
Recently these scientists relayed a human voice from New Jersey to California via one familiar satellite, the moon, and also sent a signal several hundred miles by means of an aluminized balloon.

Many features of the telephone service we take for granted today once sounded as improbable as this. But working always on the frontier of science is one of the ways we make that service more convenient, economical and enjoyable for you.

BELL TELEPHONE SYSTEM



Tomorrow's telescopes may be huge mirrors that gather faint electronic radiations from stars.



A Problem in Celestial Gunnery

The moon, as the nearest body to earth, is the logical first step on the way to exploring the planets. But it is a difficult target, for the inconstant moon has the most irregular orbit of any body in the solar system. As it wobbles in a slightly undulating course, counterclockwise around the turning earth, it describes an orbital plane (yellow disk) inclined about five degrees from the plane on which the earth orbits the sun (red disk). The earth's orbital plane in turn is tilted even more from the earth's equatorial plane (blue disk). Hence the moon rides eccentrically above and below the equatorial plane, shifting about so that a particular position recurs in a given month only once about every eighteen years.

To hit such a shifty target from the moving earth, some 250,000 miles away, requires some hair-raising computations in long-range celestial gunnery. At the moment when the moon rocket is fired from earth, the moon is at the first position (the bottom one in the diagram). But the rocket must be aimed at where the moon will be (second position) some two and a half days later; it will take that long for the spaceship projectile to get there. A small angular error in aiming from earth will cause the rocket craft to miss the moon by thousands of miles. Once on course at the right velocity, however, the craft climbs up the steep bump of the earth's gravity field (shaded green background) and toboggans down its thinning flank into the lower gravity field of the moon (dark area). The return voyage takes off from the moon's third position.

Major stages in this round trip are shown here as they might happen in a week in June. The mission may be launched from earth either by direct ascent, using a single huge rocket, or from rendezvous in earth orbit, the primary method now favored. In one rendezvous method (see left-hand panel) two medium Saturn C-5 rockets will be used. The first one puts a propulsion stage into orbit, then the second propels the spacecraft into orbit, slightly ahead of the first unit. The propulsion unit chases while the spacecraft's velocity is retarded, until they meet and clamp together. The combined vehicle is now ready to blast out of orbit toward the moon.

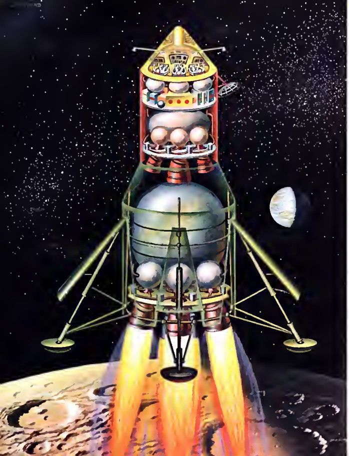
Directed from Canaveral's computer center, the spacecraft is put on an elliptical path centered as accurately as possible in an imaginary tunnel (yellow cone) leading toward the moon. At mid-course the craft sights on two stars and the moon for a course correction, if needed. Hazards on the trip, requiring special shielding, are the Van Allen radiation belts (curved lines in magnetic field), cosmic rays (gray streaks), and solar flares (pink streaks).

In the moon's vicinity the spacecraft falls into its gravity field at a speed of about 6,000 miles per hour. This speed is braked by rockets, which turn the craft onto an orbital course. Then the landing maneuver is executed (middle panel). Piloted by radar into proper altitude and position above the moon, the craft is turned about and its landing-stage rockets fired against gravity to lower the ship softly to the moon's surface.

Launching the ship on the return trip from the moon's low gravity, one-sixth that of earth, requires only modest thrust from the craft's final launch stage. With computer assistance from Canaveral, the ship is again guided into a narrow tunnel, this time aimed at earth. As it falls into earth's strong gravity field, it enters the most hazardous part of its journey. Speeds reach up to 25,000 miles per hour, building up tremendous heat. And re-entry must hit a precise, forty-mile-wide corridor (right panel). Wide of this, the craft will shoot off to be lost in outer space; short of it, descent will be too steep and Apollo will burn up.

The Voyage to the Moon

by Lawrence Lessing



The Landing

The great spaceship Apollo, as artist Max Gschwind conceives it, is shown here nearing the craters of the moon someday late in this decade. Around it the stars gleam unwinkingly in the moon's airless sky. Far off, shining brighter than the moon itself, is the earth, on which man only recently has acquired the technology to launch himself into space.

That technology will be concentrated in wonderful and fearsome complexity in the hull of the seventy-five-ton spaceship Apollo. Some idea of its scale is indicated by the three men riding in its nose, and by the fact that this whole ship is only a quarter the size of the big rocket that sent it off. Details are not yet firm, but the ship will consist of three segments.

The command module *(yellow) holds the astronauts and a maze of vital systems, including those for environmental control, waste disposal, flight guidance, communications, and check-out. Through an air lock in the tip the crew can climb out and lower themselves to the moon's surface.*

The service module *(red) contains electric power units, additional oxygen-air supplies, and other utilities serving the pressurized cabin above. In addition, it holds fuel tanks and rocket units for making in-flight corrections or emergency escapes back to earth, and for launching the return voyage from the moon.*

The lunar-landing module *(green) consists entirely of a large rocket stage, which is fired to decelerate the craft from approach speeds to a soft landing. Landing gear folds out to take up any shock. The burned-out stage later serves as launch pad from which the rest of Apollo will take off for the return trip to earth.*

Landing a manned vehicle on the moon by 1970 became a goal of U.S. national policy just a year ago. The project heralds an age of exploration that will illuminate the darknesses of the solar system just as the voyages of Columbus, Magellan, and Vasco da Gama opened up man's knowledge of his own planet. In more immediate terms, it represents the greatest, most intricate mobilization of government, science, and industry ever attempted outside of war. But before all this, it poses a massive problem in science and technology.

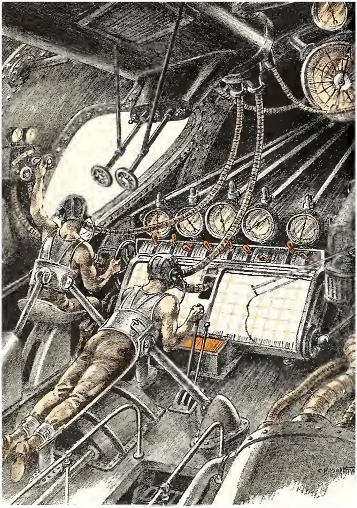
It is a problem of maintaining human life for many days in an utterly unfamiliar condition of weightlessness inside a capsule hurtling through an entirely foreign and hostile environment where no respirable air, no food, no water, no life is known to exist. It is a problem of aiming, guiding, and controlling this cargo through the trackless vacuum of almost empty space (see overleaf) with a precision and reliability that challenge all modern industrial arts. And it is finally a problem of returning this package through the inferno of re-entry into the earth's atmosphere at speeds around 25,000 miles per hour, and decelerating it to bring the man back softly to the bosom of mother earth. It is an unparalleled multiple problem in biology, medicine, astrophysics, mathematics, communications, chemistry, materials, and, principally, engineering and brute mechanics.

The first and most urgent engineering challenge is the development of the propellant power to hurl some 75 tons of men and matériel some 250,000 miles to the surface of the moon and safely bounce them back again. The rocket power or thrust required to push such a load up to escape velocities of about 25,000 miles per hour at the top of the atmosphere and on to the moon is far beyond anything so far achieved in missilery or demonstrated in space, either by the U.S.S.R. or by the U.S. The top Soviet achievement so far is about one million pounds of thrust, used to launch the five-ton Vostoks into earth orbit last year. That is about three times the thrust and payload developed in the U.S. Mercury program, but still far from the ultimate power required. For the moon shot, at least a six to twelvefold increase in the rocket

continued page 120

Overleaf, diagram of the lunar journey

At the Controls of an Aircraft of the Futur



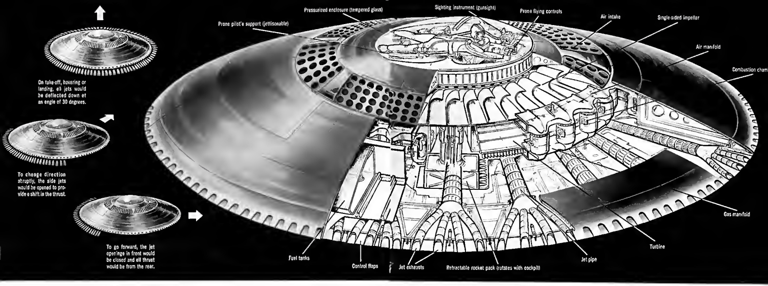
An Artist's Conception of the Way Rockets Will Be Guided in Their Flights through Space by Pilots Strapped in a Sealed Compartment

MAN-CARRYING ROCKET SHIPS PRESENT MANY PROBLEMS

Rocket-propelled airships of the future may resemble present-day Zeppelins, except that they will be equipped with stubby wings that telescope into the sides of the craft when not needed. Ships big enough to carry passengers still present many problems, but those experimenting with such a form of travel are already speculating on the construction and operation of the craft when they do make their appearance. Some German inventors believe these ships will be catapulted into the air as is now done with airplanes, and will ascend at the start with the aid of short wings. Upon reaching the stratosphere, the wings might be withdrawn into the hull after which rockets alone would provide the power. In leaving the earth, the speed of the craft would be held down because the occupants would be unable to withstand the tremendous pressure, but at a height of about 600 miles, the ship might be expected to attain its full speed, estimated at 250 miles a minute, a journey from Paris to Chicago requiring fifteen minutes at such a rate. The crew of a rocket ship of this sort would be strapped in places in an air-tight compartment with its own oxygen and heating plant. At a speed of 250 miles a minute, or 15,000 miles an hour, landing would present as much of a problem as the actual flight. In descending, experimenters believe the wings would again be brought into use and possibly rockets in the bow would be employed to aid in braking and reducing speed.

BAKELITE HATS FOR POLICE GIVE EXTRA PROTECTION

German policemen now are wearing bakelite hats. Recently the standard equipment for such peace officers was changed to include molded helmets which afford protection and are more durable than steel. The headpieces resemble the patent-leather dress helmets worn by German officers during the war.


Pressurized enclosure (tempered glass)
Prone pilot's support (jettisonable)
Sighting instrument (gunsight)
Prone flying controls
Air intake
Single-sided impeller
Air manifold
Combustion cham
Gas manifold
Turbine
Jet pipe
Retractable rocket pack (rotates with cockpit)
Jet exhausts
Control flaps
Fuel tanks

On take-off, hovering or landing, all jets would be deflected down at an angle of 30 degrees.

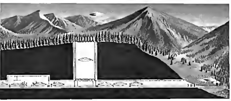
To change direction abruptly, the side jets would be opened to provide a shift in the thrust.

To go forward, the jet openings in front would be closed and all thrust would be from the rear.

This design study for a flying-saucer fighter was prepared for LOOK by Thomas Turner, a 30-year-old British aeronautical engineer now employed by Republic Aviation Corp. A Canadian saucer project that may resemble it in some details has long been rumored. Turner points out that the design could be arrived at independently and is only one of several possible approaches to the construction of saucer craft.

Is this the real FLYING SAUCER?

This revolutionary design study envisions a craft that will outrun and outmaneuver present jets and eliminate vulnerable runways needed by our air guardians



Future airports built for vertically rising flying saucers would have no need of the long, vulnerable runways today's fighters require. The complete operation could go underground. Tunnels with take-off shafts set into the ground, complete with maintenance bays, fuel and crew quarters, would be bombproof shelters for a saucer squadron. The shafts would be sealed after take-off for camouflage and protection

Produced by BEN KOCIVAR

DESPITE HUNDREDS OF "eyewitness" accounts of flying saucers, none has been captured and no government has come forward to take credit (or blame) for their reported aerial shenanigans. So, barring the possibility that the saucers are from other planets (a theory ardently supported by science-fiction fans), it seems reasonable to conclude that "there ain't no such animal."

But persistent and fairly credible rumors recur that a Canadian aircraft manufacturer, A. V. Roe, Canada, Ltd., has had a saucer design under development for two years. One report has it that the project was abandoned by the Canadian government because it would cost over $75 million to get a prototype flying model into the air. The A. V. Roe people maintain a confusing silence about the whole thing. They can't deny the project has been abandoned because they never announced it had begun. Our own Air Force offers "no comment."

At a recent meeting of engineers, it was indicated that, while flying saucer or sphere projects may still be purely hypothetical, new air-defense problems are setting up requirements for aircraft performance that would seem to be most ideally met by a saucer craft such as is illustrated above.

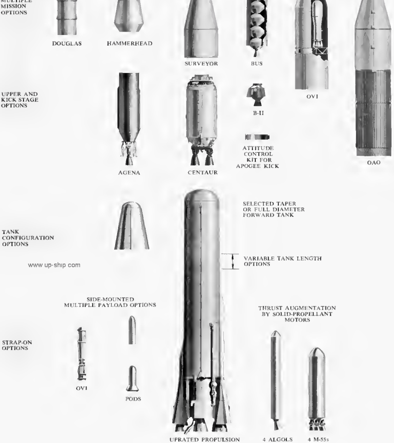
One problem, recently stated by Brig. Gen. Benjamin Kelsey, deputy director of research and development of the Air Force, is this: "Airplanes today spend too much time gathering speed on the ground and not enough flying in the air." Today's fighters, he pointed out, need extremely long runways and there are few in existence that are now long enough. These few, and the concentration of planes using them, provide a worth-while target for an A-bomb. With a single blow, the enemy might cripple a substantial portion of our air defense.

Planes that could take off vertically would not need long runways, which cost millions of dollars. They could be dispersed widely and safely. In this country, four vertical-rising aircraft already have been revealed. All but one, however, are modifications of conventional plane designs. None yet approaches the performance a true saucer might be capable of.

What are the requirements of an ideal defense fighter? 1) Ability to take off and land vertically; 2) high speed of over Mach. 2. (more than 1500 mph); 3) high rate of climb; 4) excellent maneuverability; 5) heavy armament; 6) ability to operate at 60,000 feet.

These sketches indicate a highly educated guess of what a flying saucer to fulfill these requirements would look like. It provides for a one-man crew, housed in a glass bubble that would provide excellent visibility. The prone position of the pilot not only allows improved streamlining but also enables the pilot to withstand high accelerations and quick turns. The design contemplates use of cannon, rockets or guided missiles. Exact armament would depend on the mission. The target would be sighted by radar, and actual firing would be computed and accomplished electronically, as in several interceptors now in operation.

continued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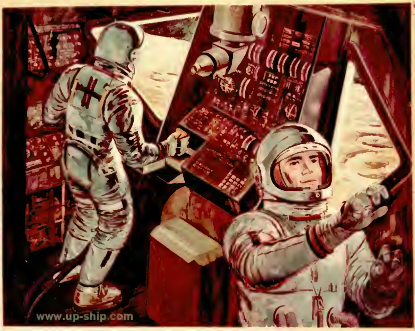

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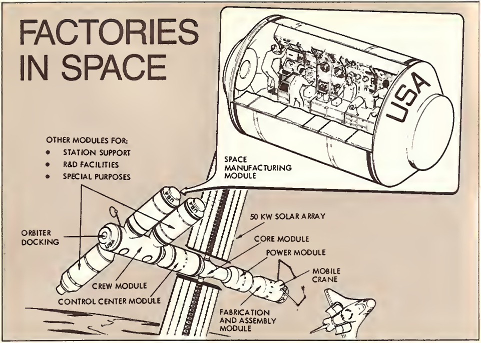
DAVID A HARDY

FACTORIES IN SPACE



Courtesy NASA

Space factories will be made of a number of separate modules clustered together. Some, like the one shown in the cutaway drawing, will be used for manufacturing. Others will be used for building or repairing equipment. Still others will serve as living quarters and recreation areas.

UNITED STATES
Meltzer

Chesley Bonestell's conception of Saturn viewed from her outer moon from "The Conquest of Space" published by Sidgwick & Jackson, Gt. Britain, and the Viking Press, U.S.A.

Tomorrow to fresh fields . . . .

Through the Ages the Navigator has been the pathfinder to fresh fields of discovery.

Yesterday Navigators such as Drake and Frobisher relied on their native skill to guide their journeyings.

Today the Navigator relies on precise instruments for his mastery of terrestrial navigation, by sea and air.

Tomorrow development of these instruments will, no doubt, make possible the spanning of the Universe and the navigation of outer space.

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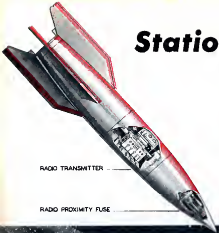
THE SPERRY GYROSCOPE COMPANY LTD., GREAT WEST ROAD, BRENTFORD, MIDDLESEX. Telephone: EALing 6771

Station MOON

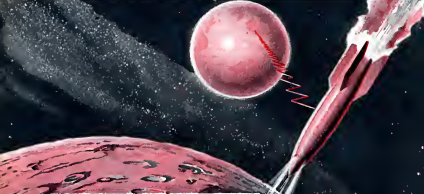
Radio rocket planned by Army would send hourly signals from the Moon.



STATION MOON may soon be calling Earth. The U. S. Army is constructing a Moon-bound radio-carrying rocket which it expects to complete early in 1948.

The missile will weigh only 100 lbs., including a 50-lb. radio capable of transmitting its signals across the intervening quarter-million miles of space.

At its calculated speed of 4,000 mph, it should reach the Moon in 60 hours. A time device will turn on the radio for one minute of broadcasting every hour, both during the journey and for several days after landing. A proximity fuse will detect the nearness of the Moon, cut off the forward rockets and turn on reverse ones, providing an easy landing.



Official NACA photo

Moon rocket builders are studying closely NACA'S missile shown being test-fired above. Two tails carry separate power plants—when its fuel is exhausted, the rear tail drops off.

53
... NOW SHOWING

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L-5
4

The Next Frontier?

By ISAAC ASIMOV
Paintings by PIERRE MION

I DID NOT REALLY UNDERSTAND what L-5 was like, on this July day in A.D. 2026, until I no longer saw it from my vantage point in space.

On the shuttle flight I had observed by telescope the torus that we all recognize, much like a bicycle wheel, gleaming in the direct light of the sun and in the light reflected from the large mirror floating free above. The six spokes and the central hub were visible too, of course.

The shuttle craft was built for durability, not comfort, and I welcomed the end of our journey—a three-day flight. As we moved in toward the docking module, L-5 stopped being a torus in space and became a habitat, a world with 10,000 people. The hub is a sphere 130 meters in diameter, which seemed huge when we were immediately above it. The six spokes led out to the torus proper, the nearer edge of which was 765 meters away. What it

(Continued on page 81)

Shape of things to come? Even as Apollo and orbiting Skylab recede into history, American scientists consider a more awesome enterprise—a permanent colony in space. Here a cargo tug maneuvers to dock at L-5, where 10,000 people live under artificial gravity in an encircling tube called a torus. Their mission: to build more colonies as well as satellites for beaming solar energy to icy-blue earth.

MARCH 25 CENTS

POPULAR MECH NICS

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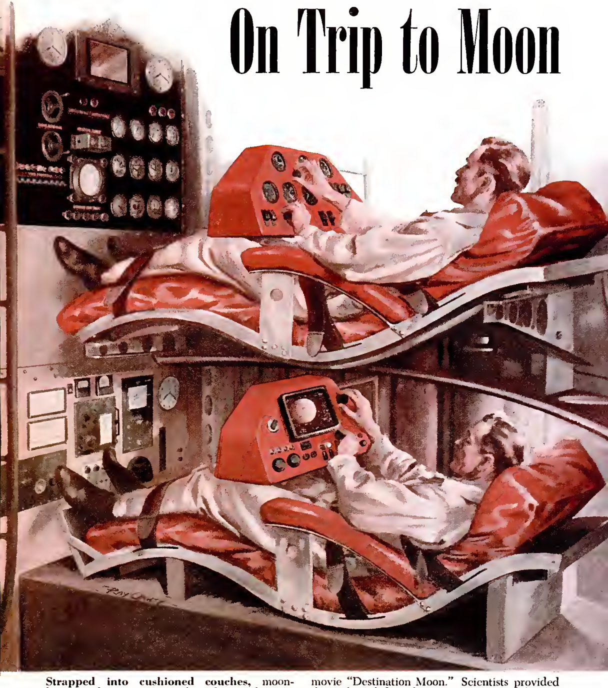
SEE PAGE 386

How Movies Take You On Trip to Moon



Strapped into cushioned couches, moon-bound rocket crewmen, each performing his own job, await take-off from earth in forthcoming movie "Destination Moon." Scientists provided the technical data, but outer space posed some problems only Hollywood could solve.

DELL
Movie Classic

NO. 1148
Still 10¢

I AIM AT THE STARS

The Wernher von Braun Story

The big-as-space drama of the satellite launchings . . . and how Wernher von Braun is turning science-fiction into reality!

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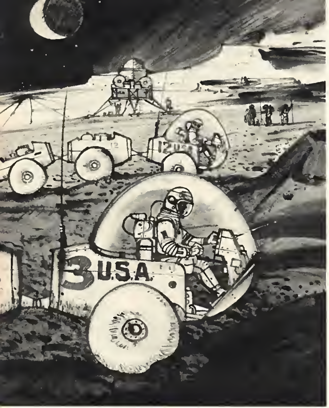
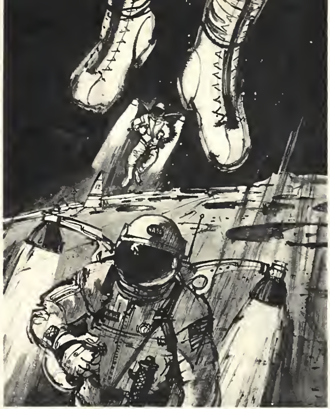
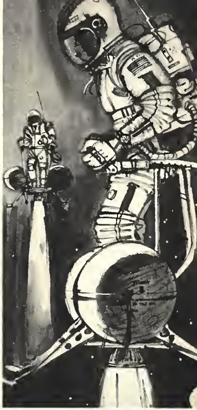






rimmed craters, desertlike "seas," and deep, powdery dust. The astronauts and their equipment, in the low pressure lunar gravity, will weigh only one-sixth of what they do on earth, and it will be difficult to keep anchored to the ground. At the same time, six times as much weight can be lifted. Earth will appear to the men as their "moon."

In this harsh and hostile environment, these adventurers of the century can exist outside their moonship only in their space suits, which will create their own atmosphere and protect them from the temperatures, radiation and pelting meteorites. Gas jets strapped to their backs will help them get around, but not for any great distances. Limited oxygen supplies will limit the astronauts to an area of a few hundred yards surrounding their space machine.

These first lunar explorers will spend only a few hours on the moon—certainly not more than one day and one night as we know it on earth as opposed to a lunar "day," which can take from two weeks to six months, because the moon rotates so slowly. Then they will start their three-and-a-quarter day trip back to earth in the same vehicle in which they arrived.

For extended visits and explorations, specialized living quarters and extraordinary vehicles will be necessary to cover the vast lunar surfaces, which are almost as large as the North and South American continents together. These vehicles cannot be propelled by air-breathing motors, but will depend on solar cells or nuclear reactors. They will operate from a large barrellike home-base vehicle, which will provide living quarters and protection for six men for periods as long as three months, along with communications and scientific facilities.

The moon will almost certainly be manned by the early 1970s. A few years after that, the flat desert areas believed to exist on Mars—six months space travel away from earth—are expected to be reached. Of the eight planets in our own solar system, not counting the earth, space scientists think that Mars is the place where the probability of life is the greatest, most likely in the form of mosslike growths, as well as bacteria and viruses. Advanced moon equipment will bare their secrets.

On these pages, space artist Robert McCall vividly depicts some of the tools and the basic ways that man plans to probe the planets.

The proposed four-track lunar mobile laboratory (page *71*) will allow two men to spend 14 days exploring over 250 miles of the moon's surface. The 80 inch-diameter wheels, folded into the side of the mobile lab in the lunar terrain. Both the tracks and the wheels will be lowered like the landing gear of a plane after arriving on the moon. These lunar rovers will be delivered to the moon months ahead of their two-man crews, unloaded and tested by remote control. The scientist-explorers to operate them will arrive by larger spaceship. Transfer will be made in pressure suits, like that worn by the astronaut in the foreground. Inside the mobile lab's sealed cabin, the men will be shielded from radiation and other hazards. Observations will be made with remotely controlled "arms" and "hands," through several windows and periscopes, and with stereo TV cameras. Power will be by hydrogen-oxygen fuel cells radiation. Such machines are expected to be on the moon in the mid-1970s.

(Left above.) By the 1980s man is expected to land on Mars. First explorations will be short trips away from the nuclear-powered spaceship, shown in the background, which will carry the solar scientists from earth, a neighboring planet or an orbiting way station. Temperatures on Mars are not believed to be as extreme as those on the moon, but the atmosphere is probably a *near*-vacuum and the radiation is heavy. Unlike the moon, the surface of Mars is thought to be largely flat. Space suits worn by the first Mars men will be propelled by gas jets strapped on the back.

Flying platforms (center above) are envisioned as a means of transporting lunar explorers over the moon's surface at rapid speeds. Stand-on machines would relieve astronauts of the weight and bulkiness of back-mounted systems on their space suits. Extra fuel tanks could extend the vehicle's range. This type machine is being considered for use by the first men to land on the moon in our Apollo capsule. In an emergency this lunar transporter could be used to transfer men from one craft to another in a space-rescue effort. On the moon men using this vehicle could stay away from their Apollo spacecraft for as long as 48 hours.

(Right above.) This proposed "moon jeep" would carry two men. It would be delivered in an unmanned cargo carrier, to be used as needed. By 1990 such vehicles are expected to be used as taxis and trucks between the several research centers set up then on the moon at widely spaced locations. A shuttle service from earth will supply the main stations and these jeeps will feed the more remote and smaller locations, along the lines of the setup in operation in Antarctica today.

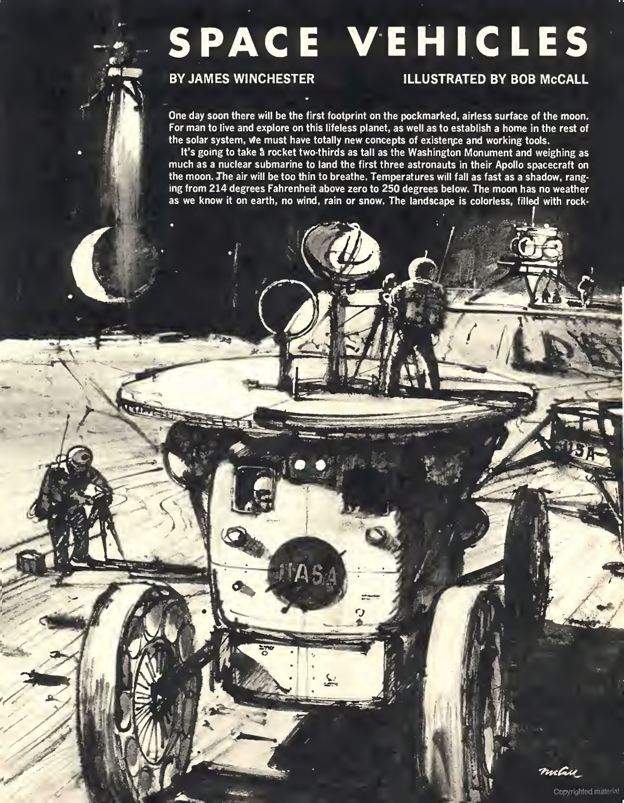
SPACE VEHICLES

BY JAMES WINCHESTER

ILLUSTRATED BY BOB McCALL

One day soon there will be the first footprint on the pockmarked, airless surface of the moon. For man to live and explore on this lifeless planet, as well as to establish a home in the rest of the solar system, we must have totally new concepts of existence and working tools.

It's going to take a rocket two-thirds as tall as the Washington Monument and weighing as much as a nuclear submarine to land the first three astronauts in their Apollo spacecraft on the moon. The air will be too thin to breathe. Temperatures will fall as fast as a shadow, ranging from 214 degrees Fahrenheit above zero to 250 degrees below. The moon has no weather as we know it on earth, no wind, rain or snow. The landscape is colorless, filled with rock-



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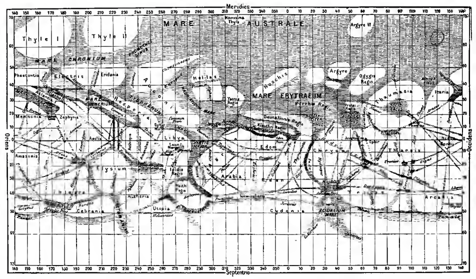
Meridies
Septentrio
Oriens
Occidens
MARE AUSTRALE
Novissima Thyle
Thyle I
Thyle II
Argyre II
PROMETHEI SINUS
MARE CHRONIUM
Phaetontis
Electris
Eridania
Ausonia
Hellas
Noachis
Argyre
Ogygis Regio
BOSPORUS SINUS
Icaria
MARE SIRENUM
MARE CIMMERIUM
Hesperia
MARE TYRRHENUM
HADRIATICUM MARE
Yaonis Regio
MARE ERYTRAEUM
Pyrrhae Regio
Protei Regio
Thaumasia
SOLIS LACUS
Memnonia
Zephyria
Cyclops
Syrtis Minor
Libya
Deucalionis Regio
MARGARITIFER SINUS
AURORAE SINUS
Aeolis
Aethiopis
Amenthes
SYRTIS MAJOR
Edom
Chryse
Ophir
Tharsis
Nectar
Amazonis
Elysium
Isidis Regio
Arabia
Eden
Aetheria
Neith Regio
NILIACUS LACUS
Tempe
Arcadia
Utopia
Cebrenia
Cydonia
ACIDALIUM MARE
Jordanis
Hiddekel
Gehon
Oxus
Indus
Hydaspes
Ganges
Gigas
Eumenides
Boreas
Propontis
Hyblaeus
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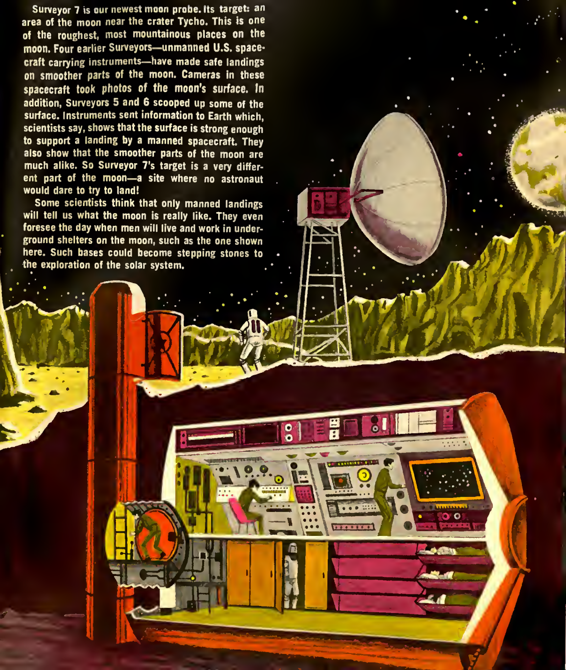
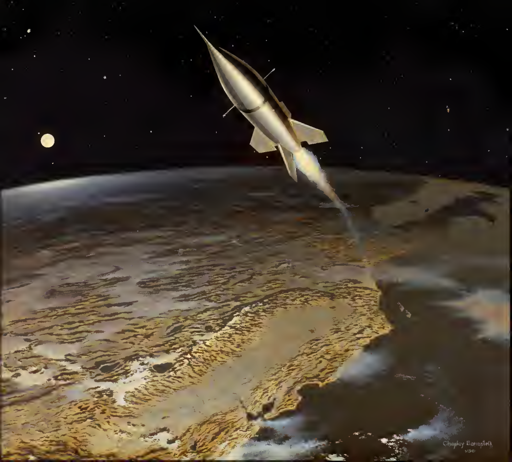
Surveyor 7 is our newest moon probe. Its target: an area of the moon near the crater Tycho. This is one of the roughest, most mountainous places on the moon. Four earlier Surveyors—unmanned U.S. spacecraft carrying instruments—have made safe landings on smoother parts of the moon. Cameras in these spacecraft took photos of the moon's surface. In addition, Surveyors 5 and 6 scooped up some of the surface. Instruments sent information to Earth which, scientists say, shows that the surface is strong enough to support a landing by a manned spacecraft. They also show that the smoother parts of the moon are much alike. So Surveyor 7's target is a very different part of the moon—a site where no astronaut would dare to try to land!

Some scientists think that only manned landings will tell us what the moon is really like. They even foresee the day when men will live and work in underground shelters on the moon, such as the one shown here. Such bases could become stepping stones to the exploration of the solar system.




Chesley Bonestell
1950

POPULAR SCIENCE

Feb. 1948 · 25c

New Guns for Human Bullets

PAGE 98

FEBRUARY 1958 ONE SHILLING

Boy's Own PAPER

In this issue

MOON ROCKETS

48 PAGES

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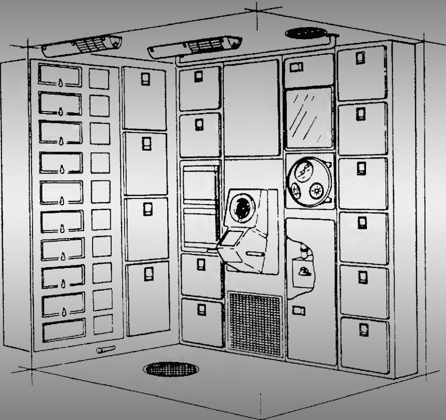
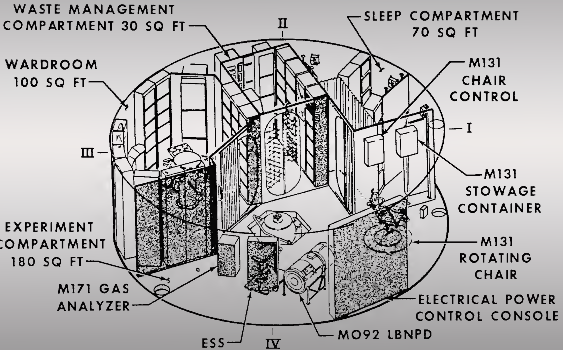
Space Happy
COLORING BOOK

Orbital Workshop
Waste Management Compartment

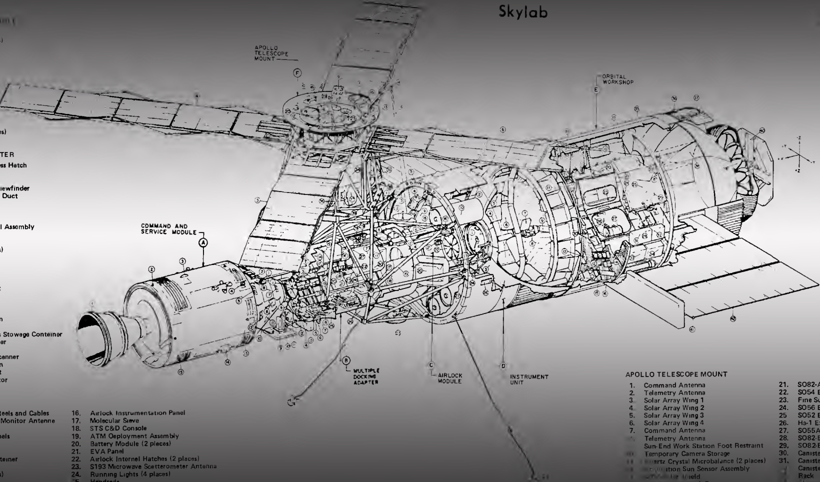


NASA-S-73-1066

ORBITAL WORKSHOP CREW QUARTERS INSTALLATIONS


WASTE MANAGEMENT COMPARTMENT 30 SQ FT
II
SLEEP COMPARTMENT 70 SQ FT
WARDROOM 100 SQ FT
M131 CHAIR CONTROL
I
III
M131 STOWAGE CONTAINER
EXPERIMENT COMPARTMENT 180 SQ FT
M131 ROTATING CHAIR
M171 GAS ANALYZER
ELECTRICAL POWER CONTROL CONSOLE
ESS
IV
MO92 LBNPD

Skylab



A. COMMAND/SERVICE MODULE

1. SPS Engine
2. Running Lights (8 places)
3. Scimitar Antenna
4. Docking Light
5. Pitch Control Engines
6. Crew Hatch
7. Pitch Control Engines
8. Rendezvous Window
9. EVA Handholds
10. EVA Light
11. Side Window
12. Roll Engines (2 places)
13. EPS Radiator Panels
14. SM RCS Module (4 places)
15. ECS Radiator

B. MULTIPLE DOCKING ADAPTER

1. Axial Docking Port Access Hatch
2. Docking Target
3. Exothermic Experiment
4. Infrared Spectrometer Viewfinder
5. Atmosphere Interchange Duct
6. Area Fan
7. Window Cover
8. Cable Trays
9. Inverter Lighting Control Assembly
10. L-Band Antenna
11. Proton Spectrometer
12. Running Lights (4 places)
13. Infrared Spectrometer
14. Film Vault 4
15. Film Vault 1
16. SO82 (A&B) Canisters
17. M512/M479 Experiment
18. Area Fan
19. Composite Casting
20. Film Vault 2
21. TV Camera Input Station
22. Utility Outlet
23. M168 STS Miscellaneous Stowage Container
24. Redundant Tape Recorder
25. Radial Docking Port
26. 10-Band Multispectral Scanner
27. TV Camera Input Station
28. Temperature Thermostat
29. Radio Noise Burst Monitor
30. ATM C&D Console

C. AIRLOCK MODULE

1. Deployment Assembly Reels and Cables
2. Solar Radio Noise Burst Monitor Antenna
3. Handrails
4. D021/D024 Sample Panels
5. (Removed)
6. Clothesline (EVA use)
7. Permanent Stowage Container
8. STA IVA Station
9. Nitrogen Tanks (6 places)
10. Oxygen Tanks (6 places)
11. Molecular Sieve
12. [illegible]
13. [illegible]
14. [illegible]
15. [illegible]
16. Airlock Instrumentation Panel
17. Molecular Sieve
18. STS C&D Console
19. ATM Deployment Assembly
20. Battery Module (2 places)
21. EVA Panel
22. Airlock Internal Hatches (2 places)
23. S193 Microwave Scatterometer Antenna
24. Running Lights (4 places)
25. Handrails
26. Stub Antennas (2 places)
27. Thermal Blanket
28. [illegible]one Antenna (2 places)

E. ORBITAL WORKSHOP

1. OWS Hatch
2. Nonpropulsive Vent Line
3. VCS Mixing Chamber and Filter
4. Stowage Ring Containers (24 places)
5. Light Assembly
6. Water Storage Tanks (10 places)
7. TO13 Force Measuring Unit
8. VCS Fan Cluster (3 places)
9. VCS Duct (3 places)
10. Scientific Airlock (2 places)
11. WMC Ventilation Unit
12. Emergency Egress Opening (2 places)
13. M509 Nitrogen Bottle Stowage
14. SO19 Optics Stowage Container
15. S149 Particle Collection Container
16. SO19 Optics Stowage Container
17. Sleep Compartment Privacy Curtains (3 places)
18. M131 Stowage Container
19. VCS Duct Heater (2 places)
20. M131 Rotating Chair Control Console
21. Power and Display Console
22. M131 Rotating Chair
23. WMC Drying Area
24. Trash Disposal Airlock
25. OWS C&D Console
26. Food Freezers (2 places)
27. Food Preparation Table
28. M171 Ergometer
29. MO92 Lower-Body Negative Pressure
30. Stowage Lockers
31. Experiment Support System Panel
32. Biomedical Stowage Cabinet
33. M171 Gas Analyzer
34. Biomedical Stowage Cabinet
35. Meteoroid Shield
36. Nonpropulsive Vent (2 places)
37. TACS Module (2 places)
38. Waste Tank Separation Screens
39. TACS Spheres (22), Pneumatic Sphere
40. Refrigeration System Radiator
41. Acquisition Light (2 places)
42. Solar Array Wing (2 places)

APOLLO TELESCOPE MOUNT

1. Command Antenna
2. Telemetry Antenna
3. Solar Array Wing 1
4. Solar Array Wing 2
5. Solar Array Wing 3
6. Solar Array Wing 4
7. Command Antenna
8. Telemetry Antenna
9. Sun-End Work Station Foot Restraint
10. Temporary Camera Storage
11. Quartz Crystal Microbalance (2 places)
12. Acquisition Sun Sensor Assembly
13. [illegible] Shield
14. [illegible] Boom
15. [illegible]
16. [illegible] Storage
21. SO82-A Experiment Aperture Door
22. SO54 Experiment Aperture Door
23. Fine Sun Sensor Aperture Door
24. SO56 Experiment Aperture Door
25. SO52 Experiment Aperture Door
26. Hα-1 Experiment Aperture Door
27. SO55A Experiment Aperture Door
28. SO82-B2 Experiment Aperture Door
29. SO82-B Film Retrieval Door
30. Canister Solar Shield
31. Canister
32. Canister Radiator
33. Rack
34. [illegible]

ZEDO INTO SPACE
COLORING BOOK

with
Model
Space Ship
on back cover

SAMUEL LOWE COMPANY
KENOSHA WISCONSIN
PRINTED IN U S A

さあ、つきたんけんだ

つきの　うえに
おりて　びっくり。
あおい　ちきゅうが
ぽっかり
ういて　いる。
きれいだな。
さあ、げつめんしゃ
おろして　たんけんだ。

■ママのメモ　月面から見る地球は、大きく（地球から見る月の約[illegible]倍）、青く、そして昇り[illegible]もせず、いつも同じところに光っています。

地球も満ち欠けして見えますが、その夜の部分には、街の灯が輝いて見えることでしょう。月面車を引き出して月探検に出発です。

LES ARTISTES ASSOCIÉS S.A.B. *présentent*

CHASSE *aux* ETOILES

RIDERS *to the* STARS

en Couleurs

WILLIAM **LUNDIGAN** · HERBERT **MARSHALL** · RICHARD **CARLSON**

MARTHA HYER
DAWN ADDAMS

UNITED ARTISTS

PRODUCTION: IVAN TORS REGIE: RICHARD CARLSON

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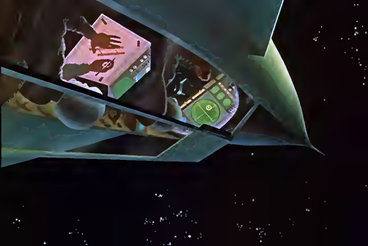
NASA

2

4



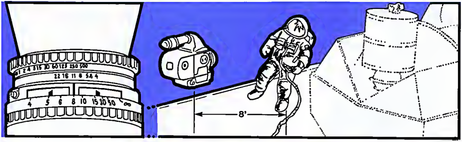


FIGURE 47 **8' is the closest subject distance**

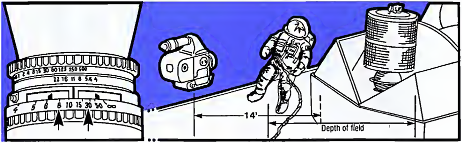
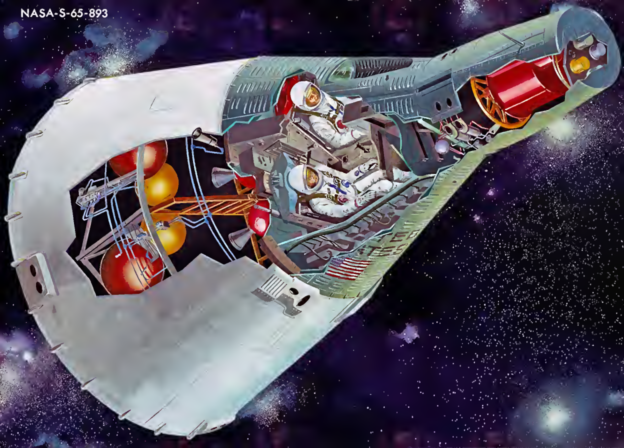


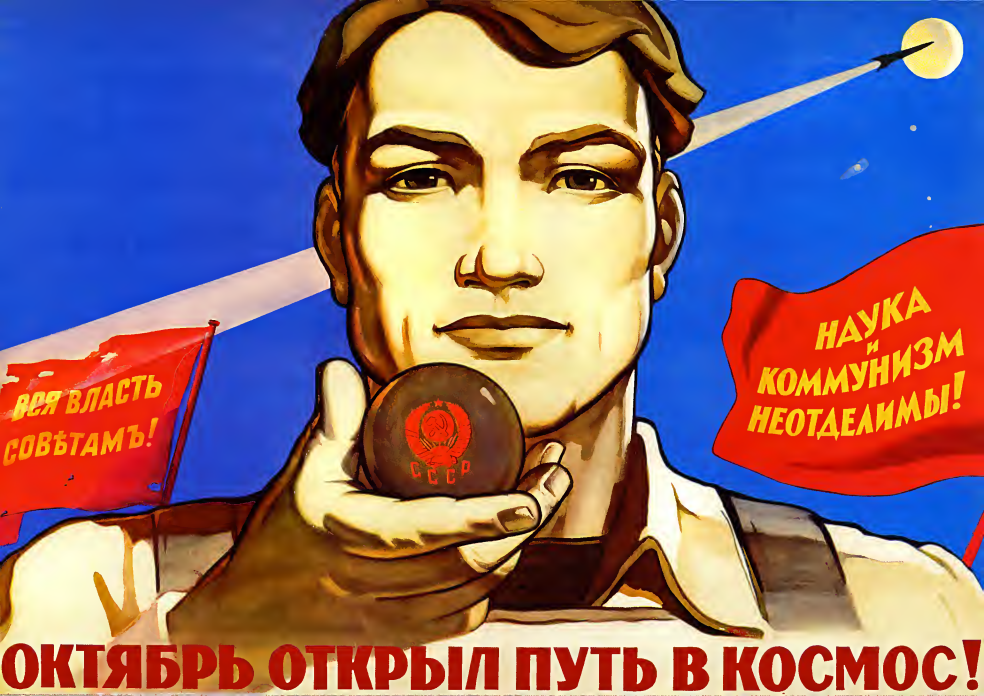
FIGURE 48 **14' is the distance set on lens**

NASA-S-65-893



US
NASA
NASA
NORTHROP

style no. 7006 (directions on page 18)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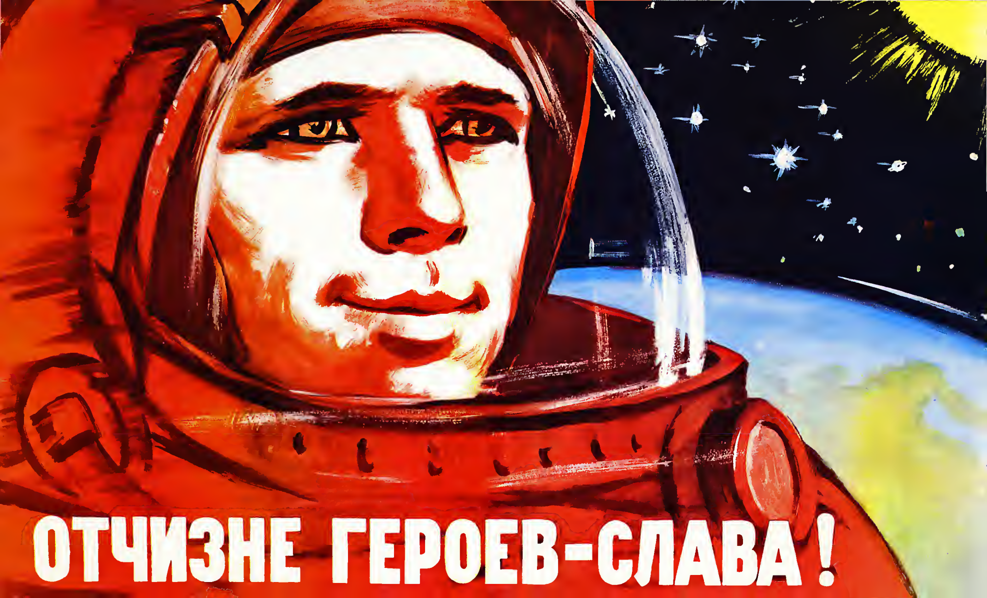
СССР
НАУКА
И
КОММУНИЗМ
НЕОТДЕЛИМЫ!
ОКТЯБРЬ ОТКРЫЛ ПУТЬ В КОСМОС!

Нам открывать миры далекие!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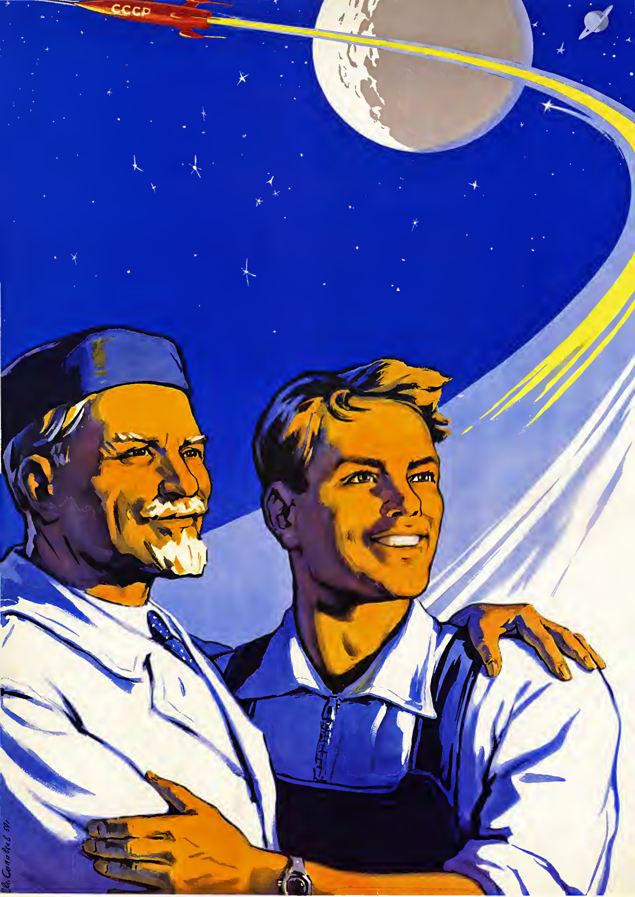
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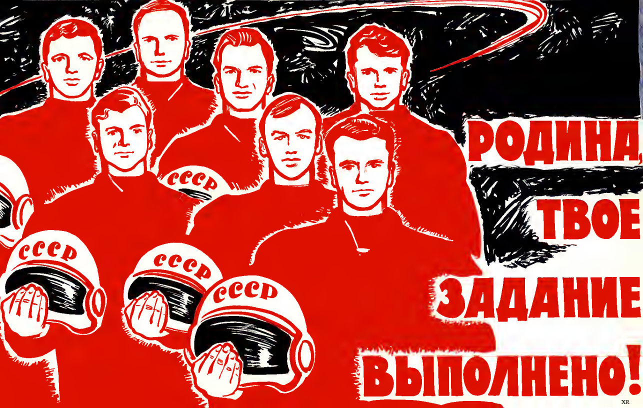

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РОДИНА,
ТВОЕ
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ВЫПОЛНЕНО!
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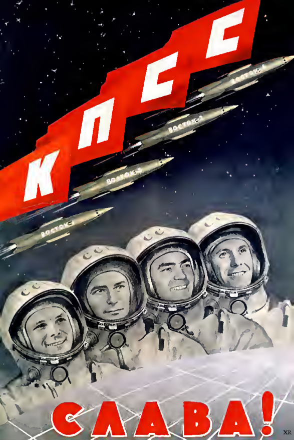

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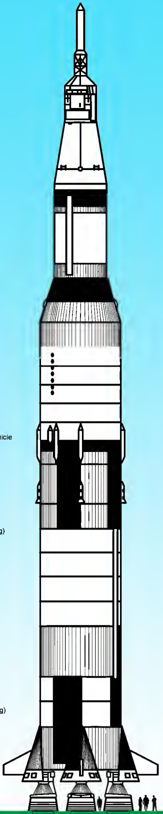
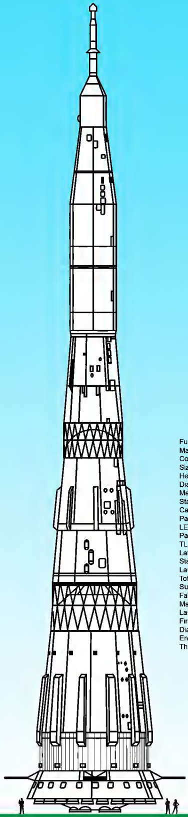


SATURN 5 - USA

Function Manned LEO and Lunar launch vehicle
Manufacturer Boeing (S-IC)
North American (S-II)
Douglas (S-IVB)
Country of origin United States
Size
Height 363.0 feet (110.6 m)
Diameter 33.0 feet (10.1 m)
Mass 6,699,000 pounds (3,039,000 kg)
Stages 3
Capacity
Payload to LEO 262,000 pounds (119,000 kg)
Payload to
TLI (100,000 pounds (45,000 kg))
Associated rockets
Family Saturn
Derivatives Saturn INT-21
Comparable N1 rocket
Launch history
Status Decommissioned
Launch sites LC-39, Kennedy Space Center
Total launches 13 (including INT-21)[1]
Successes 11
Failures 0
Partial failures 2 (Apollo 6 and Apollo 13)
Maiden flight November 9, 1967 (SA-501)
Last flight December 6, 1972
(May 14, 1973 - INT-21)[1]
First Stage - S-IC
Length 138.0 feet (42.1 m)
Diameter 33.0 feet (10.1 m)
Empty mass 288,000 pounds (131,000 kg)
Gross Mass 5,000,000 pounds (2,300,000 kg)
Engines 5 Rocketdyne F-1
Thrust 7,648,000 pounds-force

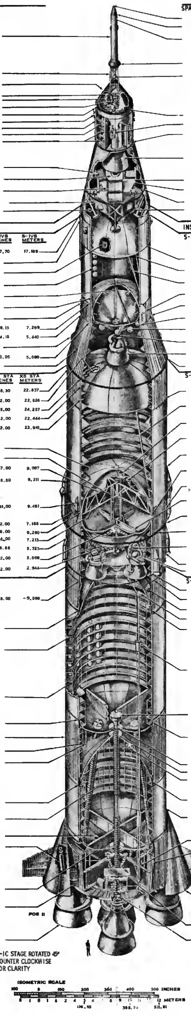


L-1 - USSR

Function Manned lunar carrier rocket
Manufacturer OKB-1
Country of origin USSR
Size
Height 105 metres (344 ft)
Diameter 17.0 metres (55.8 ft)
Mass 2,735,000 kilograms (6,030,000 lb)
Stages 5
Capacity
Payload to
LEO 90,000 kg (200,000 lb)
Payload to
TLI 23,500 kg (52,000 lb)
Launch history
Status Retired
Launch sites LC-110, Baikonur
Total launches 4
Successes 0
Failures 4
Maiden flight 21 February 1969
Last flight 23 November 1972
First Stage - Block A
Diameter 17.0 m (55.8 ft)
Engines 30 NK-15
Thrust 50,300 kN (11,300,000 lbf)

XR

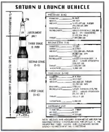
UNITED STATES
XR

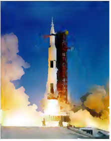

POS II
POS III
ISOMETRIC SCALE
100 0 100 200 300 400 500 INCHES
2 1 0 1 2 3 4 5 6 7 8 9 10 11 12 METERS

NOTE: S-IC STAGE ROTATED 45° COUNTER CLOCKWISE FOR CLARITY

VEHICLE STATION IN:	INCHES	METERS		
SPACECRAFT (NORTH AMERICAN AVIATION)				
LES JETTISON MOTOR & LAUNCH ESCAPE SYSTEM				
LES LAUNCH ESCAPE TOWER				
COMMAND MODULE				
COMMAND PILOT				
SENIOR PILOT				
PILOT				
SERVICE MODULE				
CARRY ON UMBILICAL	3757.17	95.432		
FLY AWAY UMBILICAL	3760.92	95.527		
FUEL SUMP TANK				
H_2 CRYOGENIC STORAGE TANK				
LUNAR MODULE (GRUMMAN AIRCRAFT ENGINEERING)				
RCS THRUSTER ASSEMBLY 4 PLACES				
L/M UPPER DOCKING TUNNEL				
L/M ASCENT STAGE				
L/M DESCENT STAGE				
L/M LANDING GEAR 4 PLACES				
INSTRUMENT UNIT (IBM)				
S-IVB (DOUGLAS)			S-IVB INCHES	S-IVB METERS
LH_2 TANK VENT	2202.36	81.570	857.70	17.189
ACCESS PLATFORM SUPPORT FITTING	3161.59	80.303		
ANTENNAS CENTERLINE	5195.56	81.116		
COLD HELIUM SPHERES (8)				
LOX TANK PROBE				
LOX TANK				
LINE FAIRING LH_2 FILL & DRAIN				
TOP OF AFT SKIRT	2932.00	71.933	289.15	7.299
LOX LH_2 FILL AND DRAIN	2750.05	70.105	214.18	5.440
RETRO ROCKET (4 PLACES)				
BOTTOM OF AFT SKIRT	2746.30	49.701	200.05	5.090
ACCESS PLATFORM SUPPORT FITTING	2664.33	87.874		
S-II (NORTH AMERICAN AVIATION)	INCHES	METERS	XS STA INCHES	XS STA METERS
SYSTEMS TUNNEL			938.30	22.837
LH_2 VENT			982.00	22.826
S-II TOP FORWARD SKIRT	2519.00	92.992	955.00	24.257
RADIO COMMAND ANTENNA 4 PLACES			922.00	22.444
TELEMETRY ANTENNA 4 PLACES			902.00	22.910
LOX TANK				
LOX PROPELLANT MANAGEMENT PROBE				
RING SLOSH BAFFLE			257.00	9.007
LH_2 RECIRCULATION SYSTEM 5 PLACES			368.80	9.211
LH_2 FILL & DRAIN			341.00	9.461
DIVISION OF AFT SKIRT			292.00	7.188
TOP OF AFT SKIRT	1890.00	49.006	326.00	9.280
BOTTOM OF SLOSH BAFFLE			284.00	7.213
TOP ULLAGE ROCKET FAIRING MOTOR			176.88	5.725
TOP OF THRUST CONE			222.00	5.808
BOTTOM OF THRUST CONE			112.00	2.944
S-IC (BOEING)				
TOP FORWARD SKIRT	1541.00	39.141	-28.00	-5.580
LOWER SECTION OF FORWARD SKIRT	1430.30	36.075		
RING SLOSH BAFFLES				
LOWER SECTION OF HELIUM BOTTLES (4)	946.30	24.041		
TOP OF INTERTANK ASSEMBLY	985.20	22.484		
FUEL VENT LINE	958.00	17.678		
ACCESS DOOR (FAR SIDE)				
LOX FILL & DRAIN (FAR SIDE)	708.18	20.172		
LOX FILL & DRAIN (FAR SIDE)	776.19	19.715		
BOTTOM OF INTERTANK ASSEMBLY	628.80	15.971		
SLOSH BAFFLES				
FUEL FILL & DRAIN	130.00	8.302		
RETRO ROCKETS (2 EACH 4 PLACES)				
BOTTOM OF FUEL TANK	225.00	5.715		
TOP OF HEAT SHIELD	112.00	2.844		
BOTTOM OF F-1 ENGINE (5 PLACES)	-115.38	-2.930		

VEHICLE STATIONS IN:	INCHES	METERS		
SPACECRAFT				
VEHICLE STATION	4240.79	107.716		
BASE OF CONARD NOSE CONE	4203.78	106.774		
CENTERLINE LAUNCH ESCAPE MOTOR	4165.53	109.212		
BOTTOM OF LES SKIRT	2960.08	100.565		
TOP OF BOOST COVER	3880.03	98.527		
VEHICLE SEPARATION	40.08	97.536		
AFT HEAT SHIELD	3748.80	95.239		
REACTION CONTROL SYSTEM MODULE	3715.45	94.372		
VEHICLE STATION FLIGHT SEPARATION	3594.55	91.301		
VEHICLE SEPARATION	3593.50	91.279		
PROPULSION MOTOR				
RENDEZVOUS RADAR ANTENNA				
LUNAR MODULE				
L/M FORWARD DOCKING TUNNEL				
VEHICLE SEPARATION	2340.05	94.837		
VEHICLE STATION	2295.19	83.443		
INSTRUMENT UNIT INSTRUMENT UNIT TOP	3258.56	92.797		
INSTRUMENT UNIT BOTTOM	3222.56	81.853		
S-IVB			S-IVB INCHES	S-IVB METERS
TOP FORWARD SKIRT			975.70	17.188
BOTTOM OF FORWARD SKIRT	2100.56	78.754	554.70	14.089
FUEL MASS SENSOR PROBE				
INSTRUMENTATION PROBE				
AUXILIARY PROPULSION SYSTEM (APS) (2)				
FLIGHT SEPARATION				
LOX VENT (FAR SIDE)	2759.00	70.078	215.15	5.414
HELIUM SPHERES (9 PLACES)				
TOP J-2 ENGINE	2845.85	97.204	100.00	2.540
J-2 ENGINE				
BOTTOM S-IVB TOP S-II	2519.00	88.969	-26.99	-.682
S-II	INCHES	METERS	XS STA INCHES	XS STA METERS
BOTTOM OF FORWARD SKIRT			923.00	20.904
LN_2 PROPELLANT MANAGEMENT PROBE				
PRESSURIZATION MAST				
LOX VENT LINE				
TOP OF LH_2 FEED FAIRING 5 PLACES			451.75	11.474
LOX TANK EQUATOR	1948	49.939		
LOX FILL & DRAIN (FAR SIDE)			207.00	5.257
CRUCIFORM BAFFLE			172.00	4.384
BOTTOM LN_2 FEED FAIRING			158.00	4.015
FLIGHT SEPARATION	1769.00	44.704	196.00	4.979
GIMBAL PLANE			100.00	2.540
BOTTOM ULLAGE R M FAIRING			-0.44	-.011
J-2 ENGINES (5 PLACES)				
S-IC				
FLIGHT SEPARATION			0.00	0.000
S-II INTERSTAGE BOTTOM	1541.00	39.141	-28.00	-0.584
LOX VENT	1521.00	36.922		
GOX LINE	1511.75	38.298		
Y RING	1404.00	35.991		
PRESSURIZATION TUNNEL (2 PLACES)				
LOX FEED LINE TUNNEL (5 PLACES)				
Y RING	909.00	22.098		
BOTTOM OF LOX TANK	772.00	19.609		
TOP OF FUEL TANK	742.00	19.945		
FUEL PRESSURE LINE	692.89	17.576		
Y RING	605.00	15.367		
TOP OF ENGINE FAIRING	362.00	9.194		
TOP OF THRUST STRUCTURE	245.79	9.780		
INTERCONNECT LOX DRAIN	120.00	3.302		
BOTTOM OF ENGINE FAIRING	49.50	1.231		
BOTTOM OF THRUST STRUCTURE	116.00	2.946		
GIMBAL	100.00	2.540		





SHEET 1 OF 2 SATURN APOLLO 500 SERIES

THE **BOEING** COMPANY
SPACE DIVISION, LAUNCH SYSTEMS BRANCH
HUNTSVILLE, ALA 35807

SATURN V APOLLO
FLIGHT CONFIGURATION

DRAWING ORIGINATED BY: HUNTSVILLE ENGINEERING
DATE: 1 JANUARY 1969
DRAWN BY: DON SPRAGUE

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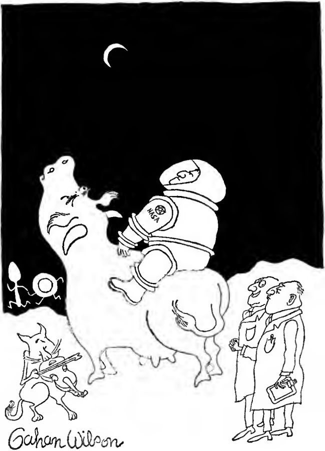
Enterprise
United States



"You can tell she's thinking it over."

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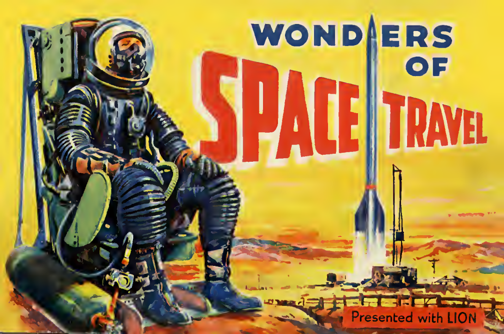

WONDERS OF
SPACE TRAVEL
Presented with LION

A Station in Space

By WILLY LEY

Noted Rocket Scientist and Author

A self-contained community, this outpost in the sky will provide all of man's needs, from air conditioning to artificial gravity

WHEN man first takes up residence in space, it will be within the spinning hull of a wheel-shaped structure, rotating around the earth much as the moon does. Life will be cramped and complicated for space dwellers; they will exist under conditions comparable to those on a modern submarine. This painting, which is scientifically accurate, shows how the spacemen will live and work inside their whirling station.

The wheel's movement around its hub will provide centrifugal force as a substitute for gravity in weightless space; however, this "synthetic gravity" will not be equal in all parts of the station, since the amount of spin will decrease toward the center. Thus, the topmost of the three decks (the one on the inside of the wheel) will have the least gravity, and the hub itself will have virtually none.

At the extreme left of the painting (below), on the top deck, is the communications center, which maintains radio contact with the earth, with rocket ships in space, and with the space taxis that carry men from rocket ship to space station. Below the communications room, meteorologists chart the weather for the entire earth; on the lowest deck at extreme left is a bunk room.

Next door to the communications and weather sections is the earth observation center, occupying two decks. On the top deck is a large movable map on which "ground zero," the territory the station is passing over at the moment, is spotted. Immediately below the map is a telescopic enlargement of ground zero. Under this, on the center deck, are additional telescopic screens showing other territoty (figures over each screen refer to the amount of territory covered by the picture, not to the apparent distance away from the scene).

The electronic computer on the top deck, between the earth observation and celestial observation centers, solves complicated mathematical problems. The large screen in the celestial observation room enables astronomers to study enlarged photographs taken from the satellite's tiny sister station, the observatory. The bottom deck contains a photographic darkroom and part of the system which recovers and purifies waste water.

The next section over is devoted to the handling of cargo. Material arrives from the hub by elevator, and is distributed from the loading room in accordance with decisions made by the weight control center, which is charged with preserving the station's balance. Fuel storage and air-conditioning return ducts are located under this area.

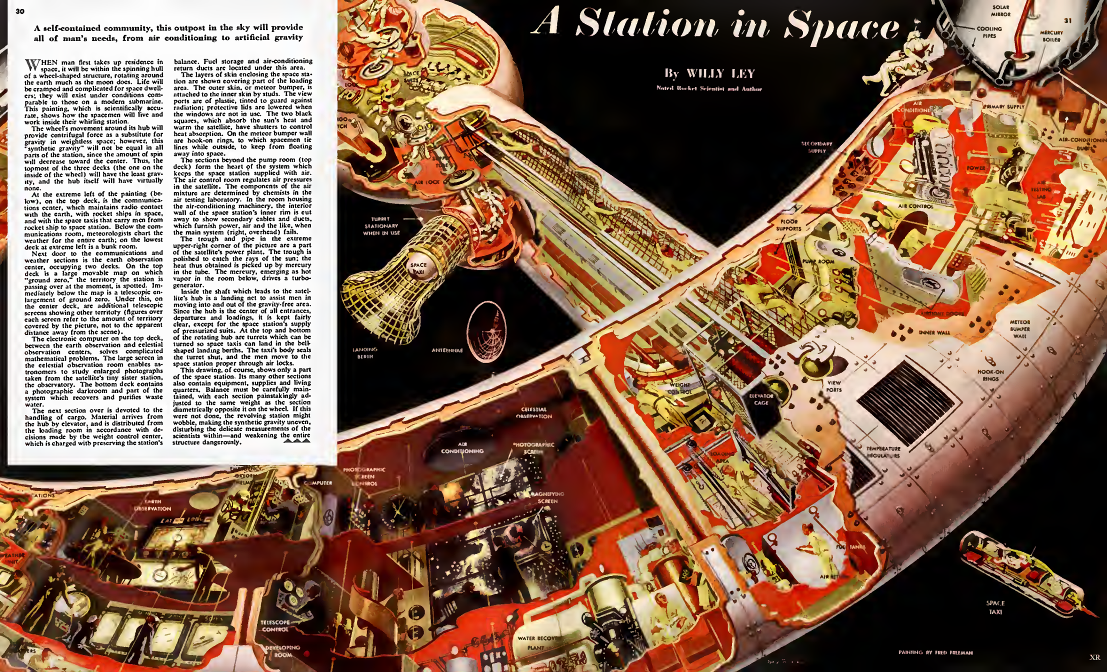
The layers of skin enclosing the space station are shown covering part of the loading area. The outer skin, or meteor bumper, is attached to the inner skin by studs. The view ports are of plastic, tinted to guard against radiation; protective lids are lowered when the windows are not in use. The two black squares, which absorb the sun's heat and warm the satellite, have shutters to control heat absorption. On the meteor bumper wall are hook-on rings, to which spacemen tie lines while outside, to keep from floating away into space.

The sections beyond the pump room (top deck) form the heart of the system which keeps the space station supplied with air. The air control room regulates air pressures in the satellite. The components of the air mixture are determined by chemists in the air testing laboratory. In the room housing the air-conditioning machinery, the interior wall of the space station's inner rim is cut away to show secondary cables and ducts, which furnish power, air and the like, when the main system (right, overhead) fails.

The trough and pipe in the extreme upper-right corner of the picture are a part of the satellite's power plant. The trough is polished to catch the rays of the sun; the heat thus obtained is picked up by mercury in the tube. The mercury, emerging as hot vapor in the room below, drives a turbogenerator.

Inside the shaft which leads to the satellite's hub is a landing net to assist men in moving into and out of the gravity-free area. Since the hub is the center of all entrances, departures and loadings, it is kept fairly clear, except for the space station's supply of pressurized suits. At the top and bottom of the rotating hub are turrets which can be turned so space taxis can land in the bell-shaped landing berths. The taxi's body seals the turret shut, and the men move to the space station proper through air locks.

This drawing, of course, shows only a part of the space station. Its many other sections also contain equipment, supplies and living quarters. Balance must be carefully maintained, with each section painstakingly adjusted to the same weight as the section diametrically opposite it on the wheel. If this were not done, the revolving station might wobble, making the synthetic gravity uneven, disturbing the delicate measurements of the scientists within—and weakening the entire structure dangerously. ▲▲▲



PAINTING BY FRED FREEMAN

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AIR FORCE
AF

DOMENICA DEL CORRIERE

Anno 61 - N. 39 - L. 40 *Settimanale del* ***CORRIERE DELLA SERA*** 27 settembre 1959

Il primo razzo sulla Luna
(Disegno di Walter Molino; vedi pagina 4)

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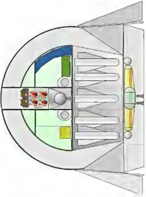
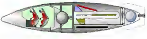
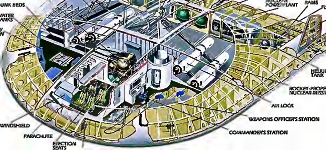


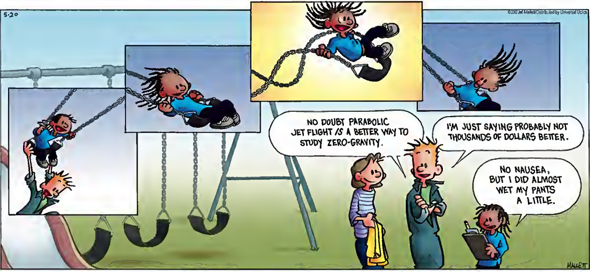



UNK BEDS
VATER
ANKS
NUCLEAR
POWERPLANT
RAMS
HELIU
TANK
ROCKET-PROPE
NUCLEAR MISSI
AIR LOCK
WEAPONS OFFICER'S STATION
COMMANDER'S STATION
WINDSHIELD
PARACHUTE
EJECTION
SEATS

XR

FRAZZ

BY JEF MALLETT

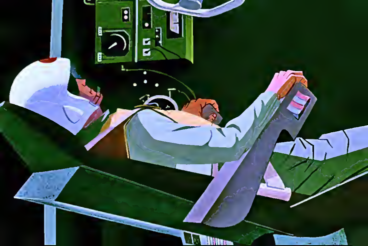

5-20
©2012 Jef Mallett Distributed by Universal Uclick
NO DOUBT PARABOLIC JET FLIGHT *IS* A BETTER WAY TO STUDY ZERO-GRAVITY.
I'M JUST SAYING PROBABLY NOT THOUSANDS OF DOLLARS BETTER.
NO NAUSEA, BUT I DID ALMOST WET MY PANTS A LITTLE.
MALLETT

XR

ЧЕЛОВЕКУ ПУТЬ ОТКРЫТ!

12 АПРЕЛЯ – ДЕНЬ КОСМОНАВТИКИ

ГУСАРОВ



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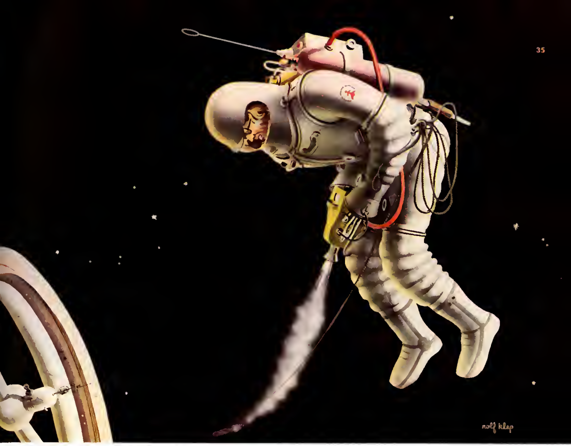


Tied to space station so he won't float away, spaceman wears radio and oxygen supply on back of pressurized suit, gets propulsion from portable rocket motor. Actual helmet will have dark glass to ward off dangerous ultraviolet rays; artist made it light to show face

CAN WE SURVIVE IN SPACE?

By DR. HEINZ HABER

Department of Space Medicine, United States Air Force School of Aviation Medicine, Randolph Field, Texas

A multitude of problems will beset us, says this authority, but nothing we can't lick

ALL day long, the frail little man attending the forum had listened to the engineers and scientists discuss the conquest of the heavens with huge rocket ships and space stations. Now he had a question.

"Mr. Chairman," he said, "you fellows seem to have worked out all the details. You know how your rocket ships should be designed, you even have plans on paper for machines to reach the moon and other planets. But as an ordinary layman who knows little about these matters, I would like to ask this one question:

"Who is going to design the crew?"

The questioner had put his finger on the greatest difficulty facing the engineers, scientists and doctors in reaching space—man himself.

If the jet plane, guided missile or rocket ship is not perfect, the engineer can redesign the machine over and over until all the kinks have been ironed out. He has a great variety of materials and devices at his disposal. He may eventually succeed in developing a flawless machine. The same cannot be said for man. He is the most important link, and yet the weakest one, in any attempt to conquer space. And he cannot be redesigned.

True, man can adapt himself to extraordinary conditions—he manages to survive anywhere on the face of this globe. But what will happen to him if he ventures into the alien environment known as space—the void beyond the atmosphere?

There is no oxygen for breathing.

The lack of atmospheric pressure can cause his blood to boil.

Dangerous radiation (ultraviolet rays) from the sun hits him with full force and can broil him within minutes.

Atomic bullets, called cosmic rays, plow through his body.

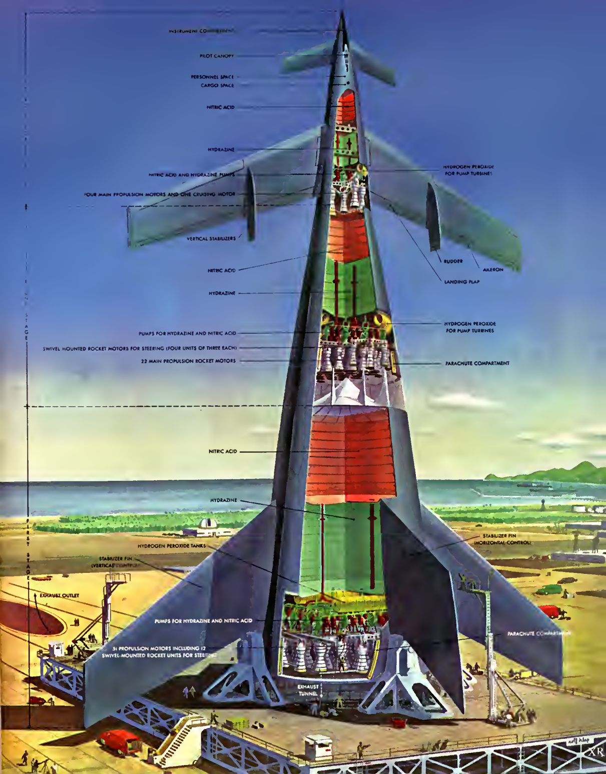
He will be weightless, floating helplessly about, with no up or down.

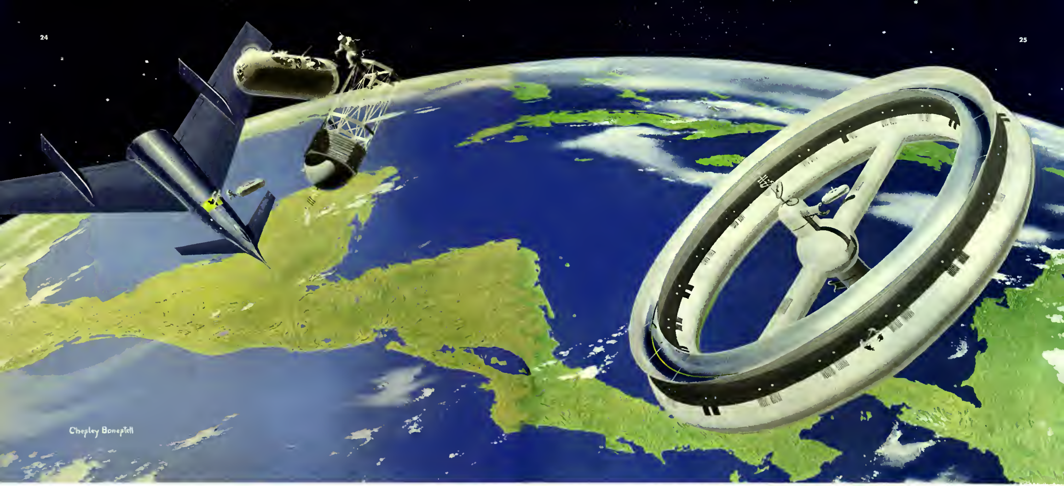
In short, man was not made to survive in the "hostile territory of space." It becomes the problem of the engineers, therefore, to create a highly mobile, self-contained, "packaged" environment for space-faring man. In other words, he needs an airtight shell to produce and preserve earthly conditions as nearly as possible.

Man is extremely hard to please in his demands, but the engineer can lick the problem and supply the crew of a rocket ship or space station with all the necessities for survival. Neither rocket ship nor space station will have the snug comfort of Mother Earth, and flying through space will be a rough job that will call for healthy, tough and physically well-trained individuals. But it can be done.

Some pessimists maintain *(Continued on page 65)*

DRAWINGS BY ROLF KLEP


INSTRUMENT COMPARTMENT
PILOT CANOPY
PERSONNEL SPACE
CARGO SPACE
NITRIC ACID
HYDRAZINE
NITRIC ACID AND HYDRAZINE PUMPS
FOUR MAIN PROPULSION MOTORS AND ONE CRUISING MOTOR
VERTICAL STABILIZERS
HYDROGEN PEROXIDE FOR PUMP TURBINES
RUDDER
AILERON
LANDING FLAP
NITRIC ACID
HYDRAZINE
PUMPS FOR HYDRAZINE AND NITRIC ACID
SWIVEL MOUNTED ROCKET MOTORS FOR STEERING (FOUR UNITS OF THREE EACH)
22 MAIN PROPULSION ROCKET MOTORS
HYDROGEN PEROXIDE FOR PUMP TURBINES
PARACHUTE COMPARTMENT
NITRIC ACID
HYDRAZINE
STABILIZER FIN (HORIZONTAL CONTROL)
HYDROGEN PEROXIDE TANKS
STABILIZER FIN (VERTICAL CONTROL)
EXHAUST OUTLET
PUMPS FOR HYDRAZINE AND NITRIC ACID
51 PROPULSION MOTORS INCLUDING 12 SWIVEL-MOUNTED ROCKET UNITS FOR STEERING
PARACHUTE COMPARTMENT
EXHAUST TUNNEL
FIRST STAGE
Rolf Klep
XR



Men and materials arrive in the winged rocket and take "space taxis" to wheel-shaped space station at right. Men wear pressurized suits. Three "space taxis" can be seen—one leaving rocket, another reaching satellite, a third near the already-built astronomical observatory

CROSSING THE LAST FRONTIER

By Dr. WERNHER von BRAUN

Technical Director, Army Ordnance Guided Missiles Development Group, Huntsville, Alabama

Scientists and engineers now know how to build a station in space that would circle the earth 1,075 miles up. The job would take 10 years, and cost twice as much as the atom bomb. If we do it, we can not only preserve the peace but we can take a long step toward uniting mankind

WITHIN the next 10 or 15 years, the earth will have a new companion in the skies, a man-made satellite that could be either the greatest force for peace ever devised, or one of the most terrible weapons of war—depending on who makes and controls it. Inhabited by humans, and visible from the ground as a fast-moving star, it will sweep around the earth at an incredible rate of speed in that dark void beyond the atmosphere which is known as "space."

In the opinion of many top experts, this artificial moon—which will be carried into space, piece by piece, by rocket ships—will travel along a celestial route 1,075 miles above the earth, completing a trip around the globe every two hours. Nature will provide the motive power; a neat balance between its speed and the earth's gravitational pull will keep it on course (just as the moon is fixed in its orbit by the same two factors). The speed at which the 250-foot-wide, "wheel"-shaped satellite will move will be an almost unbelievable 4.4 miles per second, or 15,840 miles per hour—20 times the speed of sound. However, this terrific velocity will not be apparent to its occupants. To them, the space station will appear to be a perfectly steady platform.

From this platform, a trip to the moon itself will be just a step, as scientists reckon distance in space.

The choice of the so-called "two-hour" orbit—in preference to a faster one, closer to the earth, or a slower one like the 29-day orbit of the moon—has one major advantage: although far enough up to avoid the hazards of the earth's atmosphere, it is close enough to afford a superb observation post.

Technicians in this space station—using specially designed, powerful telescopes attached to large optical screens, radarscopes and cameras—will keep under constant inspection every ocean, continent, country and city. Even small towns will be clearly visible through optical instruments that will give the watchers in space the same vantage point enjoyed by a man in an observation plane only 5,000 feet off the ground.

Nothing will go unobserved. Within each two-hour period, as the earth revolves inside the satellite's orbit, one twelfth of the globe's territory will pass into the view of the space station's occupants, within each 24-hour period, the entire surface of the earth will have been visible.

Over North America, for example, the space station might pass over the East Coast at, say 10:00 A.M., and, after having completed a full revolution around the earth, would—because the

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Collier's
March 22, 1952 • Fifteen Cents

Man Will Conquer Space Soon

TOP SCIENTISTS TELL HOW IN 15 STARTLING PAGES

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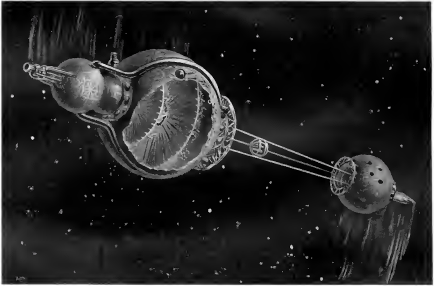
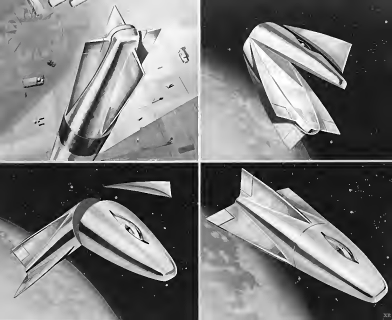


Рис. 7. Создание на космическом корабле искусственной тяжести: две части космического корабля, соединённые тросами, приводятся во вращательное движение вокруг общего центра масс.



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The
HOW
AND
WHY
Wonder Book of

THE MOON

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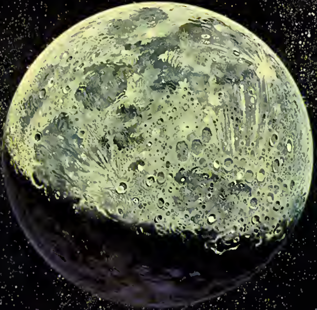

How and Why Wonder Books

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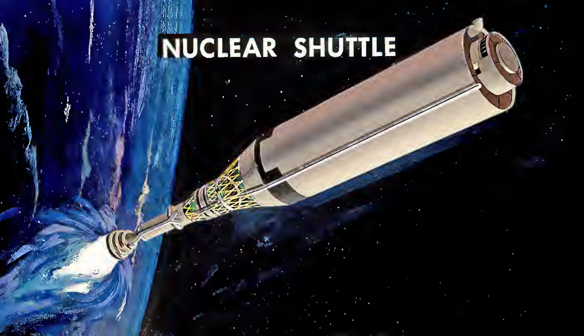
NUCLEAR SHUTTLE



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WARD KIMBALL

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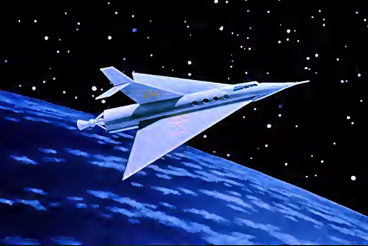
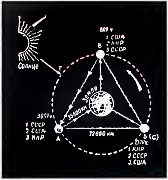
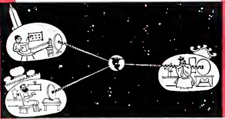


Russian Proposes GLOBAL TV



THE RATHER LIMITED conception of radio transmission we had back in 1925, when we wondered whether radio waves could be propagated through space (see opposite page), has progressed to a stage where today we are near the point of transmitting television through space. With the launching of the first Sputnik last October, the dream of global TV received a tremendous shot in the arm and it has gathered momentum with each additional satellite thrown into the sky—both Russian and American.

The magazine which first published data on Sputnik I, the Soviet periodical *Radio*, has outlined a plan which would allow nearly every TV set anywhere on earth to pick up a program transmitted from any other point. Television today, of course, is pretty much limited by line of sight, except in those areas which have coaxial cables, and a few spots which are equipped with over-the-horizon scatter facilities. The system proposed by engineer V. Petrov would make use of satellites which would pick up signals from stations on earth and bounce them to other satellites for more distant relay.

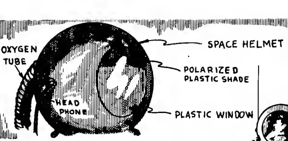


How three satellites would bounce TV signals to each other and to ground stations is shown in diagram above, taken from Russian magazine "Radio." CWA is U.S., KHP is China, and CCCP is USSR. "A" would transmit Russian signals, "B" American signals, "C" Chinese signals. At left: how a U. S. cartoonist sees it.

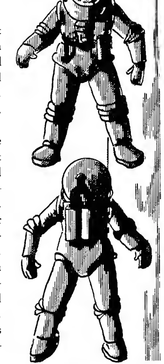
"STATIONARY" SATELLITES

If a satellite is launched from the equator so that it follows an eastward track at the proper speed and height, it will remain over one spot on

(*Continued on page* 53)

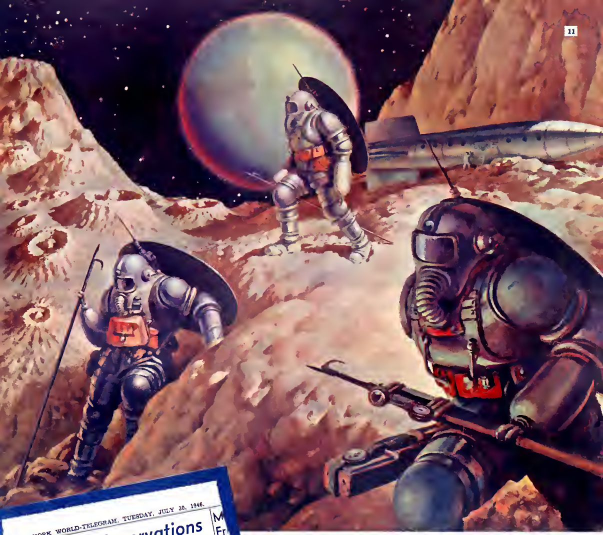


SPACE SUIT



The man who is to fly into space must take much equipment with him. To land on our nearest neighbor, the moon, he would have to take along his own oxygen. He will probably carry it in a container on his back. Without it he will not be able to breathe, as there is no atmosphere on the moon.

One of the space suits that he will have to wear while there must have a heating unit that will be especially designed to withstand temperatures of a few hundred degrees below zero during the long night on the moon. During the daytime he would have to wear an asbestos suit to protect him from the extreme heat. The temperature reaches 250°F. A helmet that will not break, but that you can see through will be necessary. And because there is no air on the moon, he will also need the helmet to be able to hear. There is no sound on the moon. Inside his helmet he will have a built-in communicat-

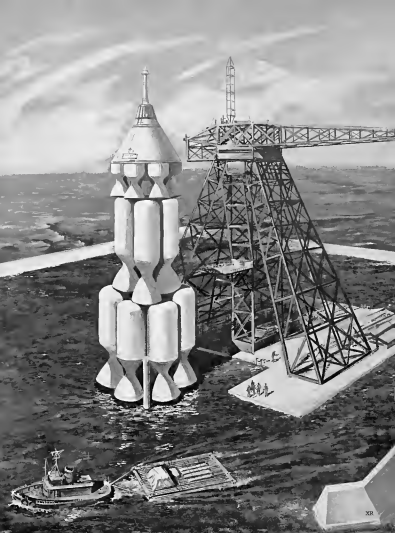


NEW YORK WORLD-TELEGRAM, TUESDAY, JULY 30, 1946.

Get Your Reservations
On Rocket to the Moon

sures explorations above the
materials an

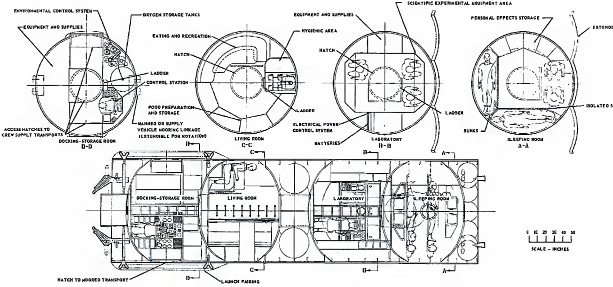
Explorers leaving the rocket will be encased in airtight, temperature- and pressure-controlled moon suits with facilities for light, power and communications. Power is generated by thermocouple effect as the sun shines on the large disks



www.up-ship.com

FOUR ROOM SPACE STATION

INTERIOR ARRANGEMENT



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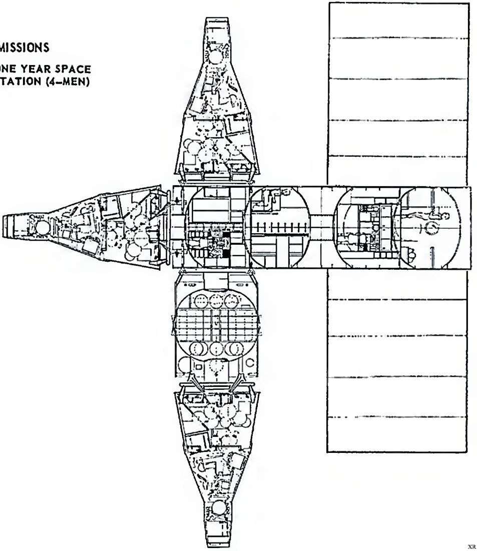
FOUR ROOM STATIONS

SHOWN AT MAXIMUM SIZE

MISSIONS

ONE YEAR SPACE
STATION (4–MEN)



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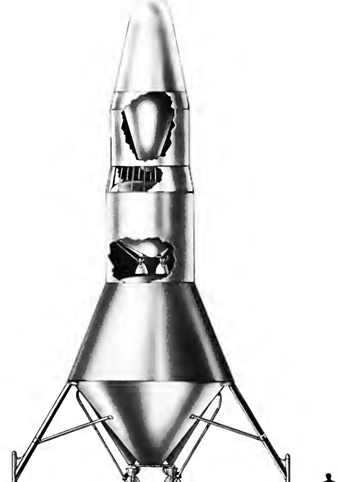

LUNAR LANDING *Vehicle*

32-16-59
MAY 59

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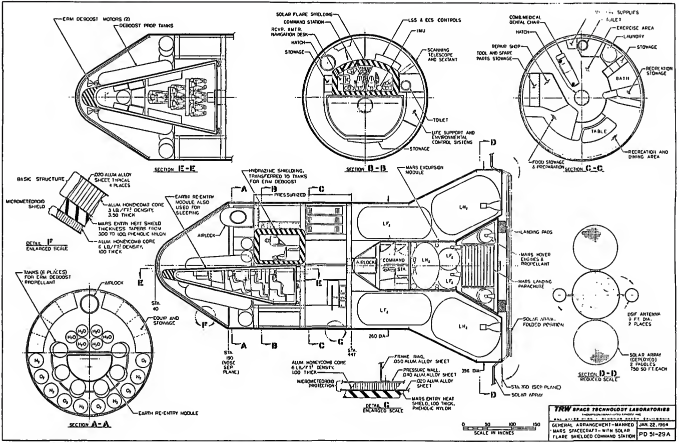
NASA
ARMSTRONG
APOLLO


ERM DEBOOST MOTORS (2)
DEBOOST PROP TANKS
SECTION E-E
SOLAR FLARE SHIELDING
COMMAND STATION
RCVR. XMTR. NAVIGATION DESK
HATCH
STOWAGE
LSS & ECS CONTROLS
IMU
SCANNING TELESCOPE AND SEXTANT
TOILET
LIFE SUPPORT AND ENVIRONMENTAL CONTROL SYSTEMS
STOWAGE
SECTION B-B
SUPPLIES
TOILET
COMB MEDICAL DENTAL CHAIR
HATCH
EXERCISE AREA
LAUNDRY
REPAIR SHOP
STOWAGE
TOOL AND SPARE PARTS STOWAGE
RECREATION STOWAGE
BATH
TABLE
RECREATION AND DINING AREA
FOOD STOWAGE & PREPARATION
SECTION C-C
BASIC STRUCTURE
.020 ALUM ALLOY SHEET, TYPICAL 4 PLACES
MICROMETEOROID SHIELD
ALUM HONEYCOMB CORE 3 LB/FT³ DENSITY, 3.50 THICK
MARS ENTRY HEAT SHIELD THICKNESS TAPERS FROM 3.00 TO 1.00, PHENOLIC NYLON
ALUM HONEYCOMB CORE 6 LB/FT³ DENSITY, 1.00 THICK
DETAIL F
ENLARGED SCALE
HYDRAZINE SHIELDING, TRANSFERRED TO TANKS FOR ERM DEBOOST
EARTH RE-ENTRY MODULE ALSO USED FOR SLEEPING
A
B
C
PRESSURIZED
AIRLOCK
MARS EXCURSION MODULE
LF₂
LH₂
AIRLOCK
COMMAND STA.
LH₂
LF₂
LF₂
LANDING PADS
MARS HOVER ENGINES & PROPELLANT
MARS LANDING PARACHUTE
SOLAR ARRAY, FOLDED POSITION
D
E
E
STA. 40
F
STA. 190 (NOSE SEP PLANE)
G
STA. 447
260 DIA
396 DIA
STA. 760 (SEP PLANE)
SOLAR ARRAY
TANKS (6 PLACES) FOR ERM DEBOOST PROPELLANT
AIRLOCK
EQUIP AND STOWAGE
H₂O
N₂
O₂
EARTH RE-ENTRY MODULE
SECTION A-A
ALUM. HONEYCOMB CORE 6 LB/FT³ DENSITY, 1.00 THICK
FRAME RING, .050 ALUM. ALLOY SHEET
PRESSURE WALL, .040 ALUM. ALLOY SHEET
MICROMETEOROID PROTECTION
.020 ALUM. ALLOY SHEET
MARS ENTRY HEAT SHIELD, 1.00 THICK, PHENOLIC NYLON
DETAIL G
ENLARGED SCALE
DSIF ANTENNA 9 FT. DIA. 2 PLACES
SOLAR ARRAY (DEPLOYED) 2 PADDLES 750 SQ FT. EACH
SECTION D-D
REDUCED SCALE
0
50
100
150
SCALE IN INCHES
TRW SPACE TECHNOLOGY LABORATORIES
GENERAL ARRANGEMENT-MANNED MARS SPACECRAFT-WITH SOLAR FLARE SHIELDED COMMAND STATION
JAN. 22, 1964
PD 51-29A

269-A

СМЕНА

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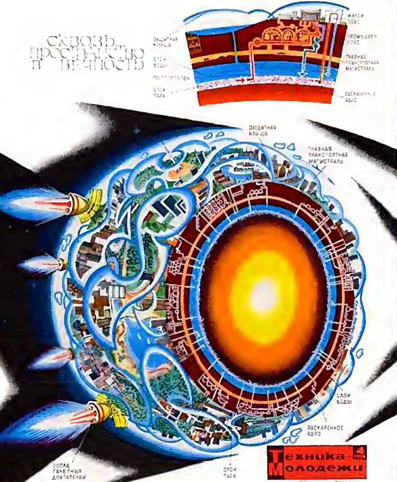
Сквозь пространство в вечность



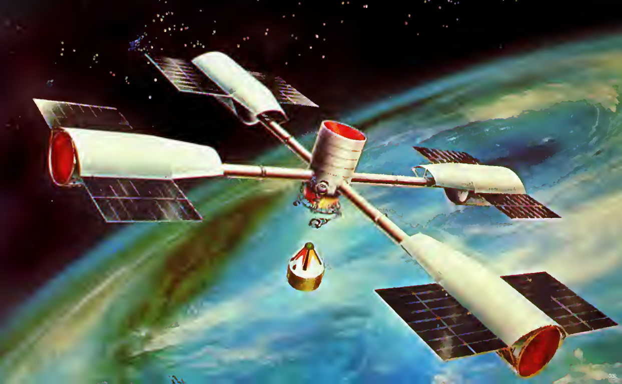
Техника — молодежи 4 1968

Цена 20 к. Индекс 70973

Межзвездная формула человека

x∈Hom→∀y,z: y⌐z∈Hom∧y=.Mat x∧z=
∀x:x∈Bes.∧∀y,z: y⌐z∈Bes.∧y=.Mat x∧z=
x∈Hom,→:xt:Ini Cor x, Ext.Ant.t.Ant.Ini x Ext

Техника — молодежи 4 1968



СОЦИАЛИЗМ

НАША СТАРТОВАЯ ПЛОЩАДКА

XR

ゆかいな ミニロケット（みにろけっと）

なんでも　しろう
しらべよう。
がんせきを　ほる
げつめんしゃ。
ミニロケット（みにろけっと）も
だいかつやくだ。

■**ママのてびき**　月面車には　大きな車がたくさんついていて、小さい割目（クレーター）や、でこぼこなどはどんどん乗り越えていきます。外に出ないでも岩石などを採集できるように、リモコン式のマジックハンドもついています。月では重さが軽くなる（地球で6㎏のものが1㎏くらいになる）ので、小さなロケットをつけた「空飛ぶ椅子」に乗って出かけることもあるでしょう。

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COVER STORY

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N WELCOME GLENN
USS.NOA (DD-841)
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XII.

NASA
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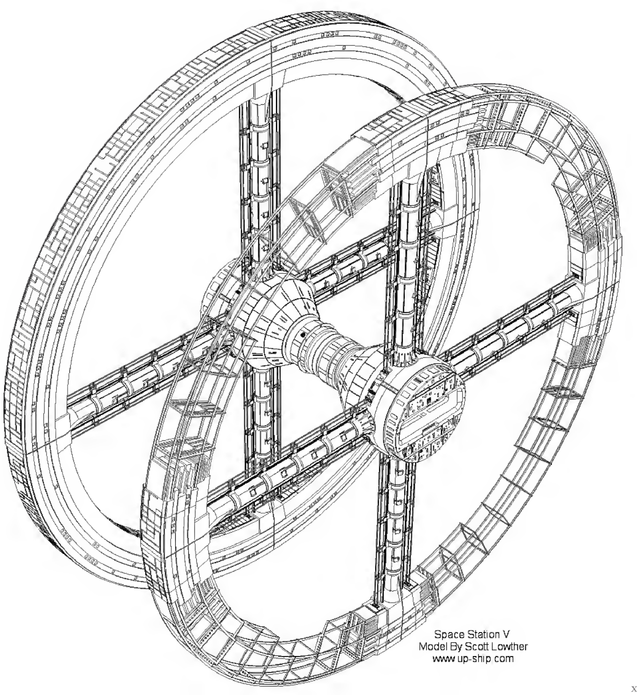

Space Station V
Model By Scott Lowther
www.up-ship.com

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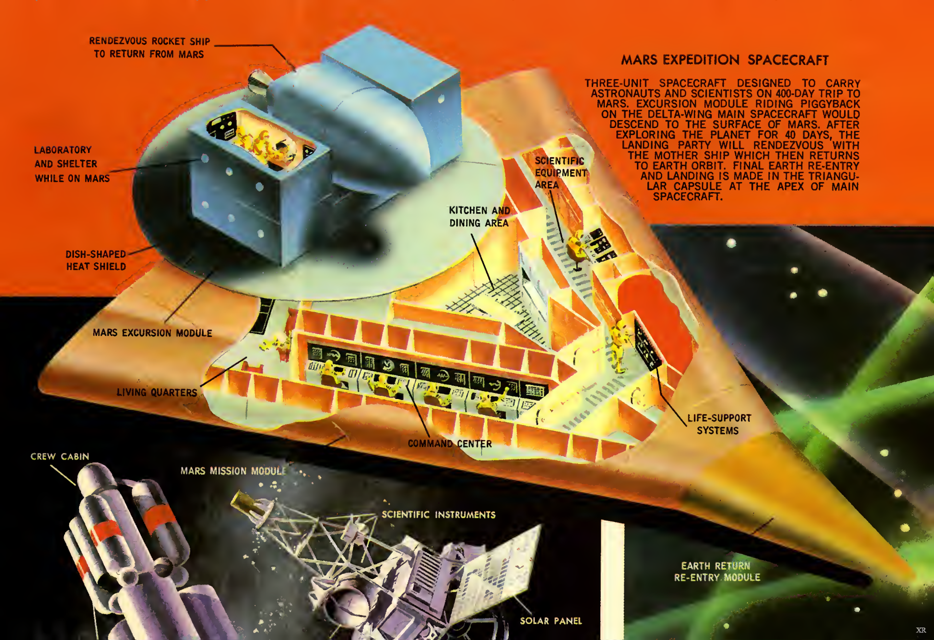

MARS EXPEDITION SPACECRAFT

THREE-UNIT SPACECRAFT DESIGNED TO CARRY ASTRONAUTS AND SCIENTISTS ON 400-DAY TRIP TO MARS. EXCURSION MODULE RIDING PIGGYBACK ON THE DELTA-WING MAIN SPACECRAFT WOULD DESCEND TO THE SURFACE OF MARS. AFTER EXPLORING THE PLANET FOR 40 DAYS, THE LANDING PARTY WILL RENDEZVOUS WITH THE MOTHER SHIP WHICH THEN RETURNS TO EARTH ORBIT. FINAL EARTH RE-ENTRY AND LANDING IS MADE IN THE TRIANGULAR CAPSULE AT THE APEX OF MAIN SPACECRAFT.

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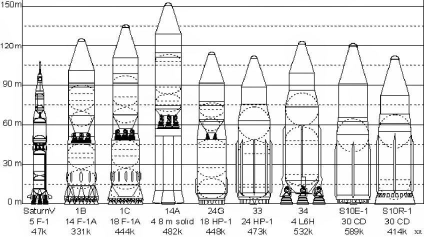
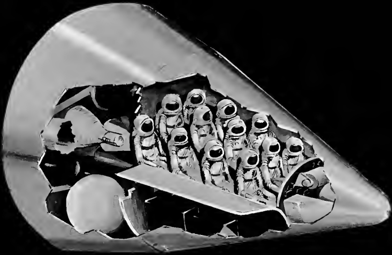
Nova - Martin Marietta Basic Designs - September 1963



12 MAN BALLISTICS REENTRY LOGISTICS S/C



NASA-MSC E H OLLING 16 APR 63 S-140-274

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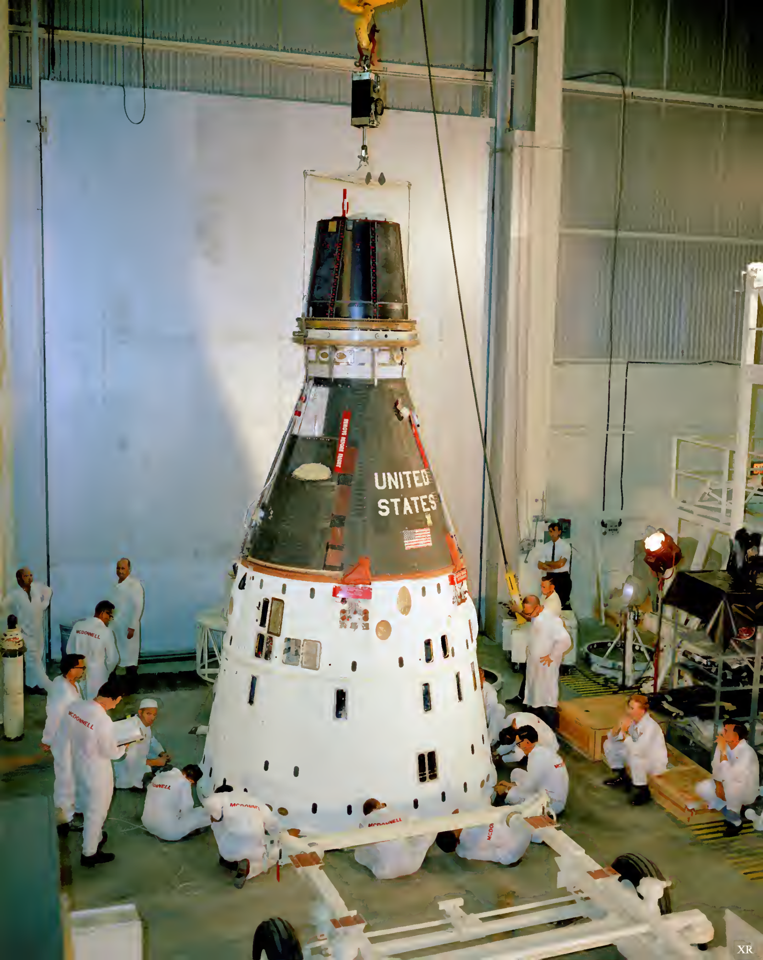

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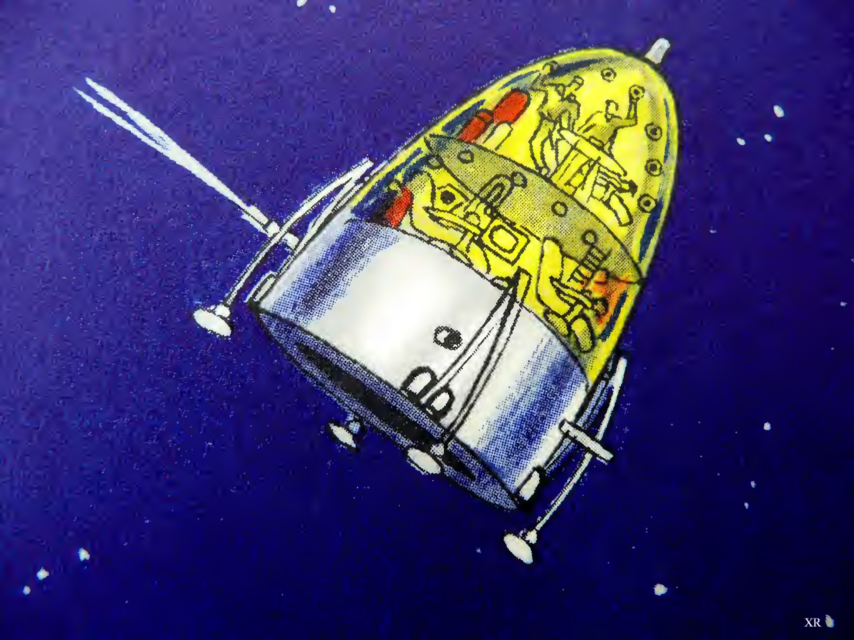

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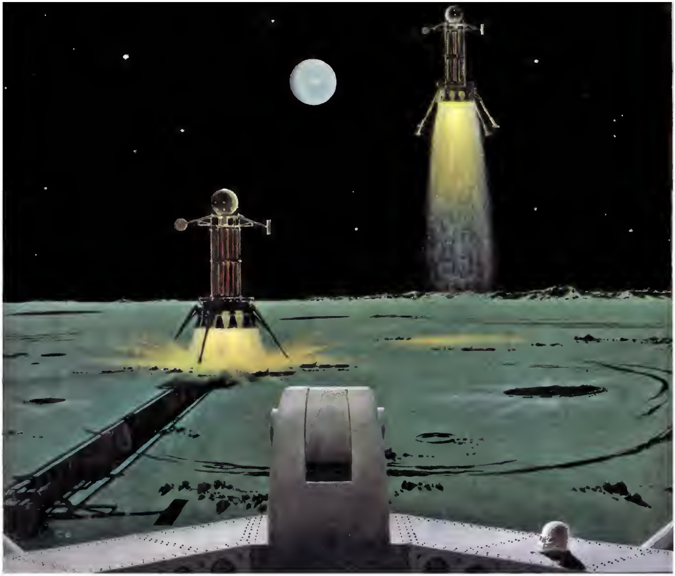

CHESLEY BONESTELL

Seen from abandoned cargo ship with "full earth" shining in sky, passenger ships take off for return trip from the moon to space station's orbit

of equipment and start hoisting men up to the catwalks of the two rocket ships. Then the cranes are folded against the framework, ready for flight.

Through the intercom, the commander of the fleet counts off the seconds to take-off. At X minus 4 seconds, a thunderous rumble sounds in the passenger spheres: the rocket motors have been started. The turbopumps are switched on, forcing hydrazine and nitric acid into the motors.

One by one, the ships slowly lift from the surface. An automatic pilot performs the complicated take-off maneuvering which will set us precisely on course for the space station circling the earth 239,000 miles away. We have timed our departure so that we shall arrive at the space station at the precise moment when its orbit is lined up with the direction of our travel.

Immediately after leaving the ground, the ship's four spiderlike corner legs are jettisoned to save weight; soon afterward, the central shock-absorbing leg is burned away by the fierce heat of the rocket motors around it.

By now, our earth-weight has returned, and we feel astonishingly heavy. As the ship picks up speed, we are made heavier and heavier by the force of acceleration, until at an altitude of 40 miles from the moon, about 2½ minutes after take-off, we weigh 3½ times normal earth-weight.

We have reached maximum powered speed at this point: 4,200 miles an hour, sufficient to counteract the moon's gravitational pull and its 2,280-mile-an-hour speed in its course around the earth. We can now cut our motors; momentum will carry us beyond the moon's gravity, and from that point on we'll simply fall toward our destination. As the flame of the rocket motors dies away, we become weightless once again.

From here on, the flight is routine. The navigators keep constant check on our flight path (we can change course by using our rockets), fixing the position of the ships in relation to star constellations and the steadily growing globe of the earth. Far behind us, and to the right, the moon becomes correspondingly smaller.

Once past the neutral point between the gravitational fields of the moon and the earth, we start our fall, picking up speed constantly. At a distance of 131,000 miles from the space station's orbit with 20 hours of travel to go, we hit a speed of 4,300 miles an hour. Eighteen hours later, a little less than 17,000 miles from the orbit, our speed reaches 10,500 miles an hour, and we start to think about slowing down. We cartwheel our ship (by using a flywheel which, turning in one direction, causes the ship to turn in the other), so the rocket motors point toward the space station. Now we watch our speed carefully. Ahead, the man-made satellite, looking like a bright star, is traveling around the earth at 15,840 miles an hour. When our speed reaches 22,200 miles an hour, we turn on the motors. Because they point in the direction of our movement, they act as brakes.

Gradually we slow down. As we get closer, we cut the motors to half power. The needle of the speed indicator backs across the dial. When it hits 15,840, our motors are off. We are now a satellite of the earth, traveling in the 1,075-mile-high orbit at just the right speed to counteract the earth's gravity. A few miles away is the space station, endlessly circling the earth at the same speed.

We are back at our starting point. Man's first exploration of the moon has ended. Space taxis speed toward us from the station. Other men pour out of the satellite's air lock to greet us.

Our next trip will be a short one: two hours to the earth, aboard one of the sleek rockets parked nearby. There, the members of our scientific panel await us—and, without question, a great crowd of earthlings, come to see the first men ever to set foot on the ancient, mysterious soil of the earth's closest neighbor in the heavens. ▲▲▲

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rope ladders then enable us to reach the rim. The party descends as far as it can into the mouth of the crater. When no further progress is possible, we lower one man by rope to examine the floor and gather lava specimens. It's tricky, dangerous work, despite the relatively slight gravitational pull, a tumble would be just as dangerous as on earth, for there's no atmosphere to retard a falling body.

We work swiftly, for our time is limited. After a day or two at the crater, we start back, making a detour to examine the mountain range to the northeast, where there are interesting rock and lava formations and cavelike holes of unknown origin. The trip home is faster than the journey to the crater; the vehicles are heavily laden with specimens, but there is light to drive by. In a few days, we're back at the headquarters crevice.

Now the six hectic weeks of exploration draw to a close. At the landing site, electronic engineers set up automatic recording instruments which will radio scientific observations to earth after we've taken off. These stations (not much larger than an office desk) house delicate instruments which record cosmic radiations, tremors caused by the impact of meteorites hitting the surface, temperature changes and other scientific data. They are connected by cables to the skeleton of the cargo ship, which we're leaving behind. The ship's solar mirror generates power for the instruments, and the dishlike antenna will flash the readings to earth. Unless these automatic stations are destroyed by meteorites, they will operate for years without human supervision.

Engineers and technicians clamber over the passenger ships, checking pumps, rocket motors and electrical connections. The day before take-off, specimens for later study, oxygen and any remaining food are loaded onto the trailers at the lunar base. The entrances to the two huts are left open, permitting the synthetic atmosphere to escape; all material in the living quarters and laboratory will now be preserved by the vacuum of space.

During the next few hours, the cranes of the two ships haul up supplies. Each lunar tractor, when finally unloaded, is parked beside the skeleton of the cargo ship, to remain until the next lunar expedition. At last the cranes complete the loading

INSIDE the LUNAR BASE

By WILLY LEY

NOTED ROCKET SCIENTIST AND AUTHOR

THE first visitors to the moon will travel 239,000 miles through space—and then go underground at their destination. For their six-week stay, their home will be in a deep chasm, for protection against meteorites and cosmic rays. The cylindrical hold of the cargo-carrying rocket ship is split into lengthwise halves, 75 feet long and 36 wide, and lowered in sections by the cranes of our lunar tractors. One of the halves becomes a laboratory, we live in the other.

In the picture at right, one tractor is seen at the lip of the crevasse, lowering scientific specimens from the surface. Expedition members may also use the crane to enter the chasm, or they may climb down the light extension ladder at the left. Between the ladder and the tractor is a power plant like those on the rocket ships: a solar mirror focuses the sun's rays on a mercury pipe, creating vapor which drives a turbogenerator.

Each of the two buildings has its own air-conditioning, oxygen and water-recovery systems (the latter captures and cleanses for re-use all the moisture in the synthetic atmosphere we have provided within the huts). The air-conditioning and water-recovery plants of the laboratory building (rear) are visible just behind the ladder, on the first floor. Next is the chemical analysis room, and, to its right, the photographic darkroom. The radio operator works in the compartment next door, keeping in constant touch with fieldworkers, and recording their reports on tape. (The tapes are passed on to the radio operator in the cargo ship for transmission to the earth.) The upper floor at this end of the building is used for supplies and water storage (note the cylindrical water tanks).

The central unit of the hut contains a two-story screen for viewing color photographs, slides and films made in the course of the scientific investigations. At the far side of the room is a physical laboratory; experiments to determine whether the moon has an atmosphere are made here, and mineral samples are checked for magnetism, radioactivity and so forth. The projection room is visible under the pipes; next to it, through the open door, is a small conference room. To the right of the conference room, behind the small ladder, is a dispensary. Records are kept on the balcony above it.

The entire right-hand section of the lab building is an entry chamber, with space suits suspended by pulleys overhead. To get in and out of the huts, we crawl through air locks. A man is shown entering the laboratory air lock; the spring-loaded outer hatch will clap shut behind him, and a twist of wheel will open the inner hatch. (The wheel can be seen in the air lock of the other building, through which a man is about to leave.)

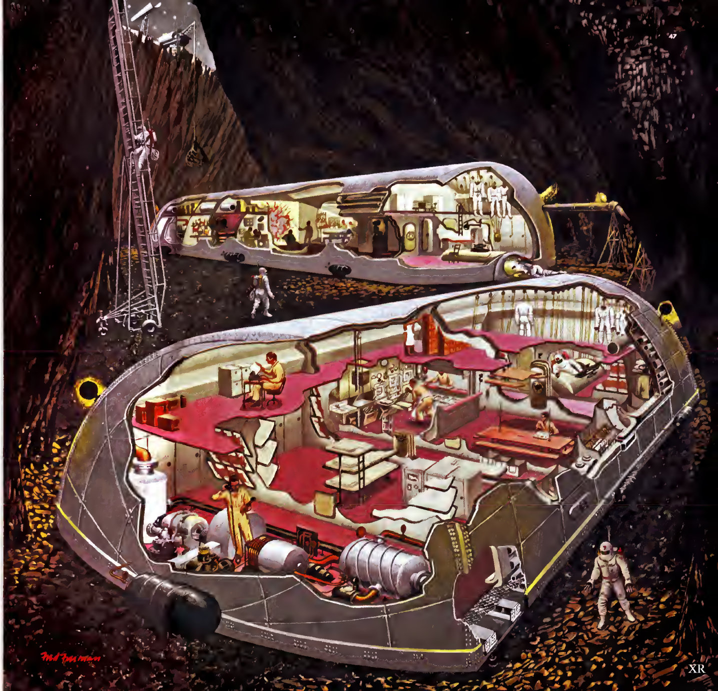
An airtight pipe connects the two huts; in an emergency, it can carry either water or air from one building to the other.

In the foreground of the hut used for living is a close-up view of the air-conditioning and water-recovery systems. The compartment behind it contains berths and lockers for most of the expedition members and, on the right, a washroom. (Bunks for the remaining personnel are on the second floor, which runs the length of the building and is otherwise used mainly for supplies.)

The large middle compartment has the expedition's kitchen and dining room. A dumb-waiter leads to the storehouse on the upper floor. The table-and-bench units in the dining area can be raised to the ceiling when not in use (one is shown in raised position). Against the right-hand wall of this section are washing machines, a hot-air drying room and a shower closet. The rearmost stalls on this wall are clothes lockers.

Oxygen supplies for both buildings are contained in the cylinders shown on the outside walls of the huts (they're placed there to save space). Also on the outer walls are floodlights to illuminate the dark interior of the chasm.

Here, 65 to 100 feet below the surface of the moon, the visitors from the earth spend most of their time during their lunar visit.



PAINTING BY FRED FREEMAN

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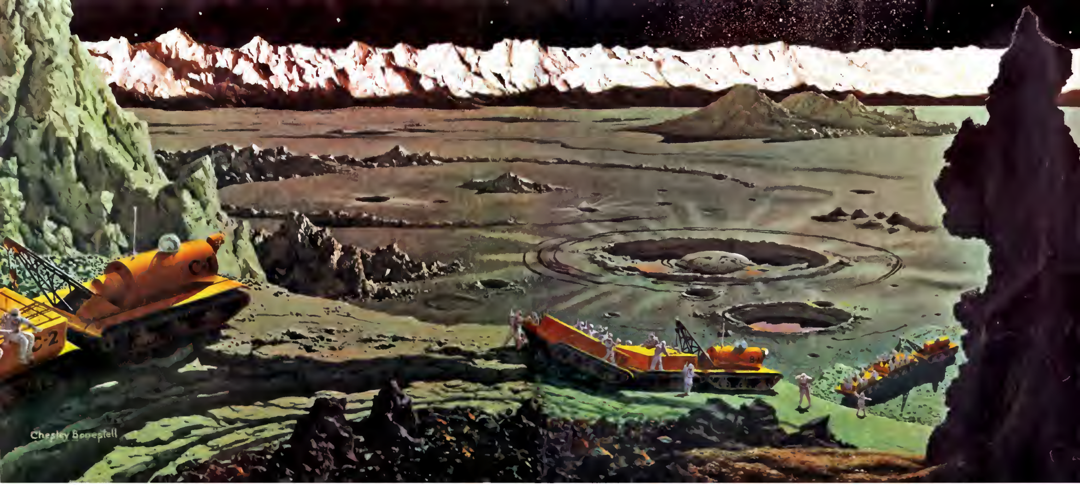

At end of two-week-long lunar day, convoy of tractors, each pulling two of its three trailers, moves cautiously across rough terrain near plain of *Sinus Roris* (Dewy Bay). Glare of mountain range to north is caused by setting sun. Remainder of scene is illuminated by greenish earth light

ture at varying depths (it may be considerably warmer than the surface, due to radioactivity).

For two weeks, we devote ourselves to research on these points, past and present. The expedition breaks up into teams, each with its own assignment. Most of the investigating during this period is done within a 10-mile radius of the base. It's difficult, dangerous work. We climb across meteor pits, into chasms, up great rock piles, struggling in our bulky suits, always fearful of snagging ourselves on sharp outcroppings, always nervous about stray meteorites and watchful for thin crust.

Because we'll never be really certain how safe we are on the moon, however long we stay, we keep up a chatter over our walkie-talkie radio transmitters, not to bolster our courage, but for a practical reason: if something happens to us, the people back at headquarters will have a record of our findings.

For the same reason, lunar headquarters maintains constant contact with the earth. Back there, a special panel of scientists remains in constant session, as it will all during our six-week stay. A dozen specialists in fields like astronomy, astrophysics, geophysics, mineralogy and geology follow our every move by radio (as, indeed, does the entire world), keeping track of our findings, suggesting new leads and occasionally asking for the repetition of an experiment. Television transmission is impractical, but every day dozens of photographs are radioed back to earth.

For those of us on the moon, the work is endless and fascinating. We collect samples of everything in sight—dust (where did it come from, what's it composed of?), mineral specimens, rock and lava fragments. Besides scouring the lunar surface, we make test drillings several hundred feet into the moon's ground, and collect more samples that way.

We work in almost frantic haste during these two weeks, trying to make the most of the brilliant sunlight. We eat and sleep in shifts, so that there will be no halt in the research, no break in the flow of information back to the earth.

But soon the sun begins to slip over the horizon. For a while, there's still plenty of light; work slows down, but not entirely. For several days after sunset, we live in a kind of twilight, with a cold, but fairly bright, illumination cast over us by the earth (it reflects about 60 times as much sunlight on the moon as the full moon reflects on the earth). The browns and grays of the lunar day take on a green tint; mountains throw long shadows; craters and chasms appear jet black. The light grows dimmer as the "full earth" becomes a "half earth."

Now comes an exciting moment: the start of our longest expedition. We've had to wait to make it, because all the vehicles have been in constant use for the vital explorations near the base; as a result, we'll have to travel outbound in comparative darkness. That's not desirable, but it's possible, and we have no alternative.

Our destination is a crater about 195 miles away as the rocket flies, but about 250 miles off by lunar tractor. This crater, called Harpalus, is the most interesting one within reach—24 miles across, with a surrounding ridge 3,100 feet high, and a depth of almost 11,000 feet from peak to bottom.

It must have taken a monstrous meteorite to smash into the moon with such force—or was it a meteorite? That's one of the questions we want answered. All we know before we start is that a meteorite *could* make such a crater—if it were the size of a small mountain, and traveling at a speed of thousands of miles an hour. Another mystery we can solve on this journey is the nature of the great white marks which radiate for tremendous distances from the most perfect (and perhaps the newest) craters. Maybe they're powdered dust, shot out by the impact of meteorite against moon; maybe their origin is volcanic. We'll soon know.

Our expedition consists of two tractors, hauling three trailers each. Ten men are making the trip, and we carry supplies and fuel enough to last about two weeks. The outbound trip should take a little less than five days, the return journey, made in sunlight, perhaps four; we also want to spend a day or two at the crater. That's 10 days. We carry an extra four days' emergency supplies.

The trip is slow and difficult. The two vehicles cautiously pick their way around great rocks and deep pits, making about two miles an hour over the rough ground. Powerful searchlights and radar probe for major obstacles; at suspicious places, a geologist hops out to scan the ground for thin crust and feel his way afoot. When, despite our precautions, one of the tractors gets stuck in a rut, the other hauls it out.

At selected points along our course, we stop and plant explosives—part of our vibration-wave experimentation—which technicians back at headquarters will fire later by remote control (the explosions will be visible from the earth through strong telescopes).

After four days, the perimeter ridge of Harpalus looms ahead. As we press on, the first rays of the sun—marking our second lunar day on the satellite—glare off the side of the ridge and the mountain range to our left. By the time we get to the base of the ridge, full sunlight pours down on us again.

From a few miles away, the crater rim is measured with surveying instruments and photographed with special cameras. As we move closer, lava samples are collected, and holes are drilled for additional specimens. Other members of the expedition take temperature readings, check for magnetism and gather dust specimens.

Scaling the crater wall is a hard job. In some places, where the ridge is rough, we can make slow progress with regular mountain-climbing equipment; elsewhere, steep walls compel us to shoot grappling hooks up the sides by means of rockets;

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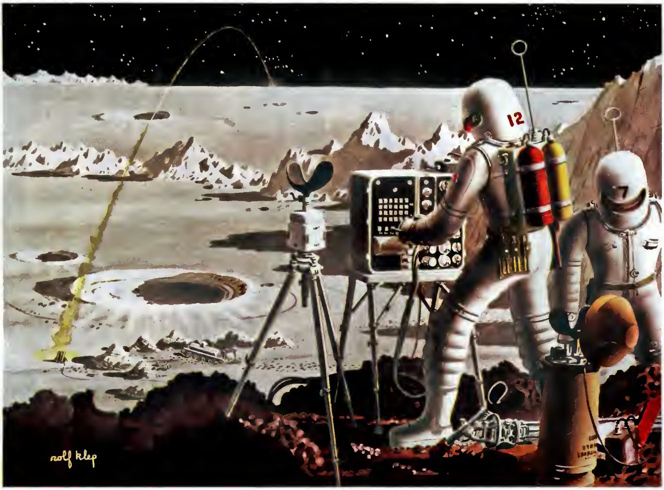


ROLF KLEP

Causing moonquakes. Rockets with explosive war heads are fired off and scientists check vibration waves caused by distant blast, to determine interior composition of the moon. Seismograph in foreground is push-button controlled and surveying instrument to its left has cupped headpiece, to accommodate hand hooks and helmets of expedition members

terious lunar valleys, the first to examine the mountains and craters of the moon close up. Who knows what we may find on this virgin ball of unexplored rock, about five times the size of the United States?

The possibilities are exciting. Suppose we turn up a great store of raw materials; maybe then we'll want to recommend setting up a permanent community. We can make it practically self-supporting, securely encased inside a great plastic dome with its own synthetic atmosphere. Such an establishment could serve as a superb scientific laboratory—especially for astronomy and for research work requiring a vacuum; as a springboard for further ventures into space (if we can manufacture our own fuel on the moon, which is a possibility, we can make tremendous savings in the launching of a space ship); perhaps as a military base (the moon would be fine for launching military rockets, but hard to hit from the earth).

But the principal aim of our expedition during this first lunar exploration will be strictly scientific—and very important. Our investigations will help us unravel the secret of the universe: how the moons and planets were born and what they're made of. Up to now, all our information on that subject has come from examination of the earth and from surveying the heavens from observatories. The moon will give us a new perspective: a different look at the astral bodies and the story of its own birth as a clue to the birth of other satellites, planets and stars.

We know that the moon didn't form in the Pacific Ocean and get hurled into space, as was generally believed 50 years ago. It *is* possible that it was an independent planet which came from outer space, fell into the earth's gravitational field, smashed into the Pacific and then ricocheted back into its present orbit. But the most likely explanation is that the moon originally consisted of a belt of gases and minerals that girdled the earth—much as Saturn's ring surrounds that planet today—and eventually fused into a solid mass.

That's the theory we'll check.

First, if there are faint traces of such heavy gases as xenon and krypton, we'll know the moon was never a completely molten, hot mass (for extreme heat would have dispelled *all* gases), and so could not have been an independent planet. We'll find out by using a rotary pump which will compress whatever gases may exist and capture them in a bottlelike container. It probably will take many days to accumulate enough of whatever gases there may be, but checking them will be fairly simple.

Does the Moon Have an Iron Core?

Then we'll look for a magnetic field. If we don't find it, we'll have another indication that the moon doesn't have an iron core, as an independent planet would. Compasslike magnetometers will do the trick for us; if the moon has magnetic poles as the earth has, they will show up (isolated iron deposits also will register, but they will be easily distinguishable from a core).

We'll also shake up the moon's surface a bit. Scientists have learned a lot about the earth from earthquakes. The vibration waves of a quake travel freely through solids, but some of them cannot pass through liquids—which is how we know that the center of the earth is molten iron. We can't count on having moonquakes, so we'll make some: we'll send off rockets with high-explosive war heads and then read the story of the waves from our seismographs. The explosions, occurring about 100 miles away, will show if the moon's core is molten (in which case, our waves will be stopped), solid (they'll go right through), or a jumble of rocks which never have been molten (muffled waves).

There is another clue to the moon's origin: the scars on its surface. The plains of the moon are rough and scored by fissures. Close examination will disclose whether these score marks are cracks or wrinkles. Wrinkles will indicate that the moon was molten at birth, and has cooled since. Cracks will be evidence that it was cool to begin with and has since been heated, perhaps by radioactivity. Fortunately, these lunar birthmarks have not been washed away by erosion, as has happened on earth.

So much for the moon's past. There are also some facts we want to learn about its present. One of the most important is the exact intensity of the cosmic rays which strike it. As soon as we're settled in our quarters, we set out instruments to measure the rays. Another is the frequency of meteorite hits. Careful measurements also will be kept of the surface temperature caused by the sun, and we'll want to measure the subsurface temperahave painted the great mountain range a blinding white against the pitch blackness of the sky. But elsewhere, there is none of the brilliant color we are used to on earth—just dull, lifeless browns and grays. There is no cloud cover, no wind, no rain or snow—no weather of any kind. Overhead, pinpoint stars shine steadily; they don't twinkle, for there is no blurring atmosphere, as on earth.

Dust-covered, drab, silent, the panorama has the frozen stillness of a faded backdrop.

Within minutes after the landing, big cranes on the sides of the passenger ships swing out and start lowering expedition members to the ground. In our cumbersome space suits, we plod through the quarter-inch dust layer toward the cargo ship, whose crewmen are already starting the unloading operation. Our movements are restricted by the suits, yet we feel light. The moon's gravity is about one sixth that of the earth; a 180-pound man weighs only 30 pounds now. We wear weighted shoes to help pin us down.

The first equipment brought out of the cargo ship is one of our three surface vehicles, tanklike cars equipped with caterpillar treads for mobility over the moon's rough surface. The pressurized, cylindrical cabins hold seven men, two-way radio equipment, radar for measuring distances and depths, and a 12-hour supply of oxygen, food, water and fuel. Power is provided by an enclosed turbine driven by a combination of hydrogen peroxide and fuel oil (oxygen escaping from the hydrogen peroxide enables the fuel oil to ignite). The vehicle goes 25 miles an hour on flat ground.

As soon as the moon car has been set down and checked, a search party boards it to scout out a suitable crevice for the campsite. They drive off in a spray of dust which settles almost immediately, like the bow wave of a motorboat (there is no air to hold the dust suspended, as on earth).

The area around the cargo ship bustles with activity. Through our earphones, we can hear a stream of orders from the engineer in charge of unloading. All orders are addressed to numbers, rather than names; faces are not visible through the heavy antiglare glass of the helmets, and we wear numerals for identification.

By the time the search party returns, the ground around the cargo ship is littered with supplies: containers of water and liquid oxygen, canned and frozen food, scientific equipment, high explosives, rockets, the other two lunar cars and nine trailers (three per car) also track-equipped.

Ship's Hold Is Converted into Huts

In all, the huge cylindrical cargo hold, 75 feet long and 36 wide, has held 285 tons of supplies (less than 50 tons, moon-weight). But the silolike hold is itself part of the cargo, and must be unloaded from the framework of the ship. Its walls are laced with wiring, air-conditioning ducts, and water and sewage pipes, split lengthwise, the cargo cabin will become two buildings like Quonset huts, and the horizontal floors which separated it into compartments will be vertical partitions. We'll live in one hut, the other will be a laboratory.

Engineers direct the unbolting of the hold from the framework, and cranes lower the huge cylinder in sections onto trailers. Two of the lunar tractors hitch up to three trailers each, and the double convoy moves silently off for the headquarters site. A third convoy, loaded with supplies and personnel, brings up the rear.

The framework of the cargo ship now stands stripped and forlorn on the barren plain, only its personnel sphere left intact. We'll leave it there and use the sphere, with its expensive radio equipment and big disk antenna, as a station for communication with the earth—lonely, but essential, duty for the radio operators.

The crevice picked for the campsite by our search party is deep—we require a depth of 65 to 100 feet for safety—with almost vertical sides. Cranes attached to the rear of the lunar tractors lower an advance squad to the floor of the chasm. It's fairly level down there, but some big chunks of rock may have to be moved to clear the way for the two prefabricated huts, pickaxes and small explosive charges do most of the work, and the cranes do the rest. Now the sections are lowered.

The front ends of the tractors are firmly anchored to the moon's surface, and one by one the hut units are eased down the side of the gully. They are quickly assembled at the bottom; electrical circuits are joined, air conditioning, water and sewage pipes hooked up—and we're ready to move in. A power unit like those on the rocket ships—a solar mirror which heats mercury to produce vapor (like steam) for a turbogenerator—is set up at the lip of the chasm.

We have now been on the moon 48 hours. There has been little sleep for anybody, but the preparatory work is over. Supplies (including our store of high explosives) are now safely out of the way of vagrant meteorites; our living quarters and laboratory are ready to use—and we'll be ready to explore as soon as we've slept.

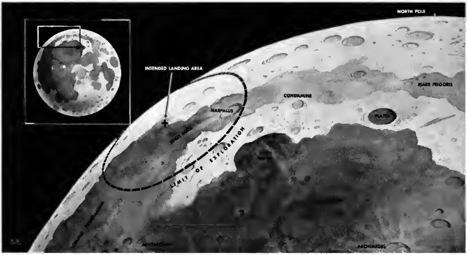
Sinus Roris, our landing area, was selected partly because of the opportunities it offers for exploration, partly because its temperature is livable—40 degrees Fahrenheit during the lunar daytime (at the lunar equator it hits a blistering 220 degrees), and 240 degrees below zero at night. That's mighty cold, but it's bearable on the airless, waterless moon, and we have heaters inside the huts.

From our headquarters site, we can explore any place within a range of 250 miles, and all the lunar features of interest to our scientists fall within that area. It may require some long trips, though—the region involved is approximately as large as the whole northeastern part of the United States, north of Washington, D.C.; in other words, the size of the six New England states, New York, Pennsylvania, New Jersey, Maryland and Delaware. Besides looking over selected sites on the side of the moon visible from the earth, we'll also be able to see a part of the unknown side—the part always turned away from the earth.

What will we be looking for?

To start with, our scientists want to know whether any faint traces of atmosphere are present, what minerals there are (maybe we'll find some rare, useful ones), whether the moon has a magnetic field like the earth and how the temperature varies beneath the lunar crust. Sheer curiosity suggests other questions and will play a large part in our explorations. We're the first people who've ever been here, the first ever to peer into the mys-

ROLF KLEP



Exploration area, within dotted line, covers 195,000 square miles, about equal to New England, New York, New Jersey, Maryland, Pennsylvania, Delaware. It lies in lunar northern hemisphere and can be seen by naked eye from earth at full moon (see inset, left)

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MAN on the MOON

THE EXPLORATION

By DR. FRED L. WHIPPLE and DR. WERNHER von BRAUN
CHAIRMAN, DEPARTMENT OF ASTRONOMY, HARVARD UNIVERSITY
TECHNICAL DIRECTOR, ARMY ORDNANCE GUIDED MISSILES DEVELOPMENT GROUP, REDSTONE ARSENAL, HUNTSVILLE, ALABAMA

Our top scientists say we'll reach the moon in our lifetime. What do we find when we get there? What are the secrets of this ball of rock five times the size of the United States? Here's expert testimony

THERE is danger on the moon—the danger of the unknown. Our first expedition, which can land there in the next 25 years, must be prepared. Tissue-damaging cosmic rays—invisible, deep-penetrating atom particles—unpredictably streak in from space, with no atmosphere to impede them. Meteorites, from microscopic grains to mountainous boulders, hurtle down. On the lunar surface, thin layers of crust might cover great crevasses, making travel perilous. Jagged rocks threaten the fabric of the pressurized, oxygen-equipped space suits essential to life.

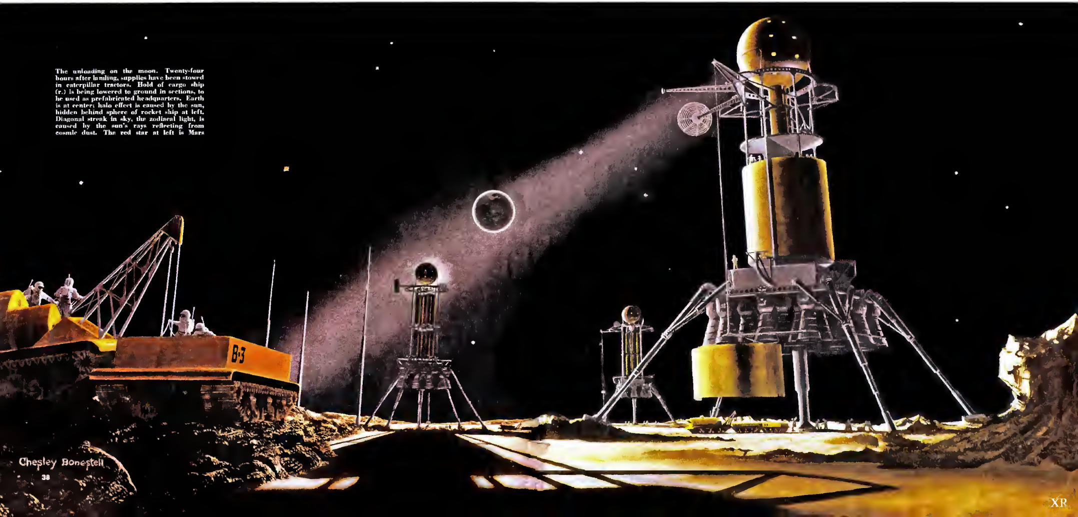
How great are the hazards? We don't know exactly, but we do know how to take precautions. Until we can measure the severity of the cosmic radiation, we shall stay under cover as much as possible. Our headquarters must be located in a deep crack in the surface, protected from both rays and meteorites. Brief exposure to cosmic radiation probably won't hurt us. Exposure to large meteorites will hurt us—but we don't expect to encounter them; the smaller meteorites will shatter against the two thicknesses of our space suits. The keen eyes of experienced geologists will guard us against break-throughs in the crust. Caution should be ample protection against rips in the precious space suits. We can explore the moon safely.

Our first step after arrival is to unload equipment and prepare for a six-week stay. Three awkward-looking but efficient rocket ships (none of them streamlined, because there is no air resistance in space) have carried us to the lunar surface from a man-made satellite 1,075 miles above the earth. On this voyage, two of the craft carried passengers and propellant for a return trip; the third, a one-way cargo vehicle, must be dismantled and converted into living and working quarters for the 50-man expedition.

We have arrived just at the beginning of the two weeks of sunlight that comprise the lunar day. From the catwalks of the ships, 130 feet above the moon's surface, the scene is dismal. The pitted surface of the landing area—a place known to scientists as *Sinus Roris*, or Dewy Bay, not far from the lunar north pole—stretches to the south like a vast, discolored expanse of broken ice.

On the other three sides, we are surrounded by towering mountains. The rays of the rising sun

CHESLEY BONESTELL



The unloading on the moon. Twenty-four hours after landing, supplies have been stowed in caterpillar tractors. Hold of cargo ship (r.) is being lowered to ground in sections, to be used as prefabricated headquarters. Earth is at center; halo effect is caused by the sun, hidden behind sphere of rocket ship at left. Diagonal streak in sky, the zodiacal light, is caused by the sun's rays reflecting from cosmic dust. The red star at left is Mars

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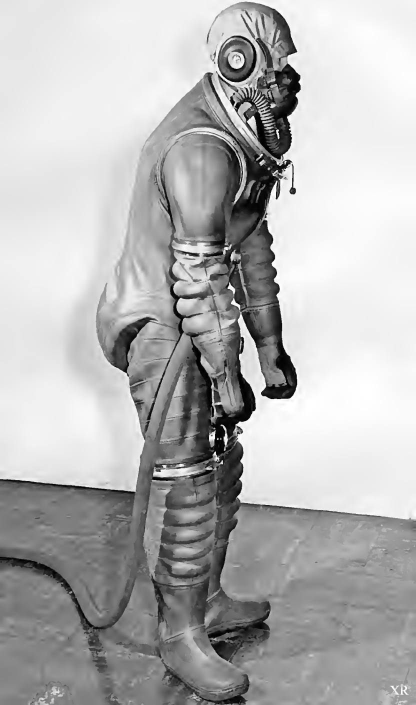
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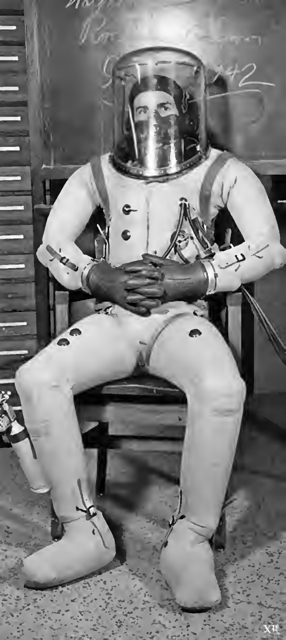

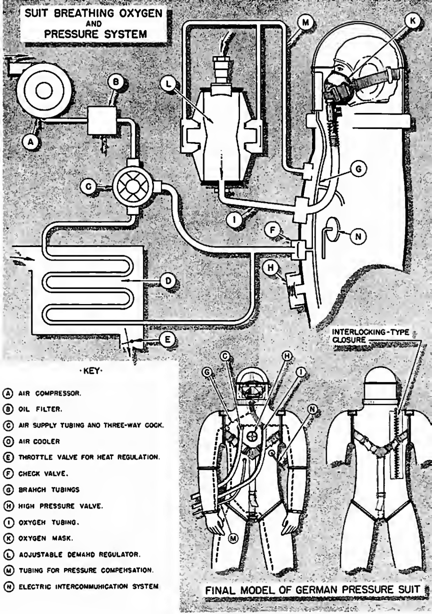
SUIT BREATHING OXYGEN AND PRESSURE SYSTEM
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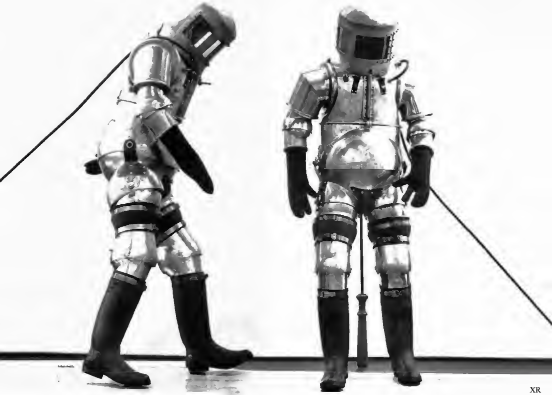
Ⓐ AIR COMPRESSOR.
Ⓑ OIL FILTER.
Ⓒ AIR SUPPLY TUBING AND THREE-WAY COCK.
Ⓓ AIR COOLER
Ⓔ THROTTLE VALVE FOR HEAT REGULATION.
Ⓕ CHECK VALVE.
Ⓖ BRANCH TUBINGS
Ⓗ HIGH PRESSURE VALVE.
Ⓘ OXYGEN TUBING.
Ⓚ OXYGEN MASK.
Ⓛ ADJUSTABLE DEMAND REGULATOR.
Ⓜ TUBING FOR PRESSURE COMPENSATION.
Ⓝ ELECTRIC INTERCOMMUNICATION SYSTEM
INTERLOCKING-TYPE CLOSURE
FINAL MODEL OF GERMAN PRESSURE SUIT

Figure 13



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С именем Ленина!
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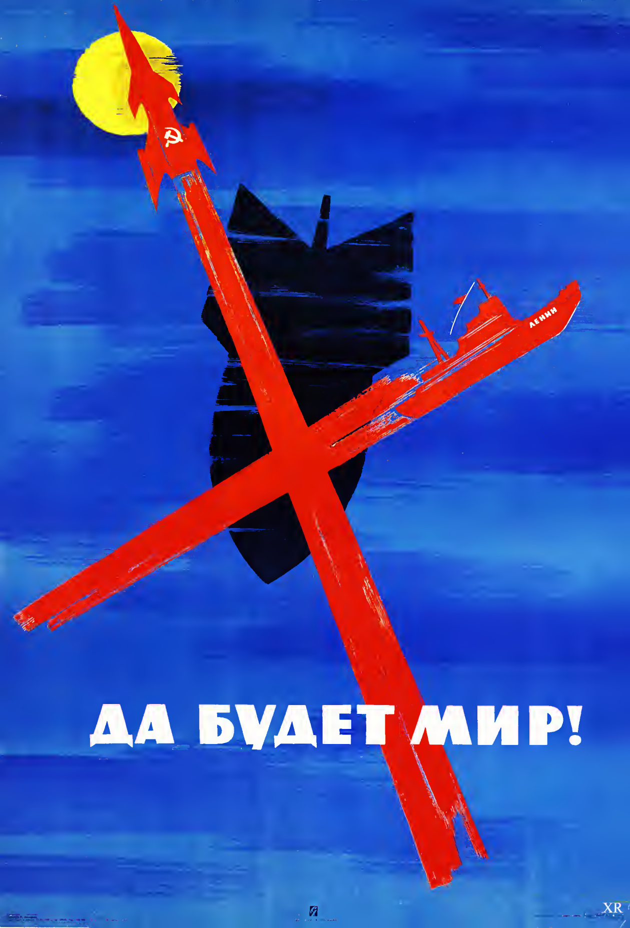
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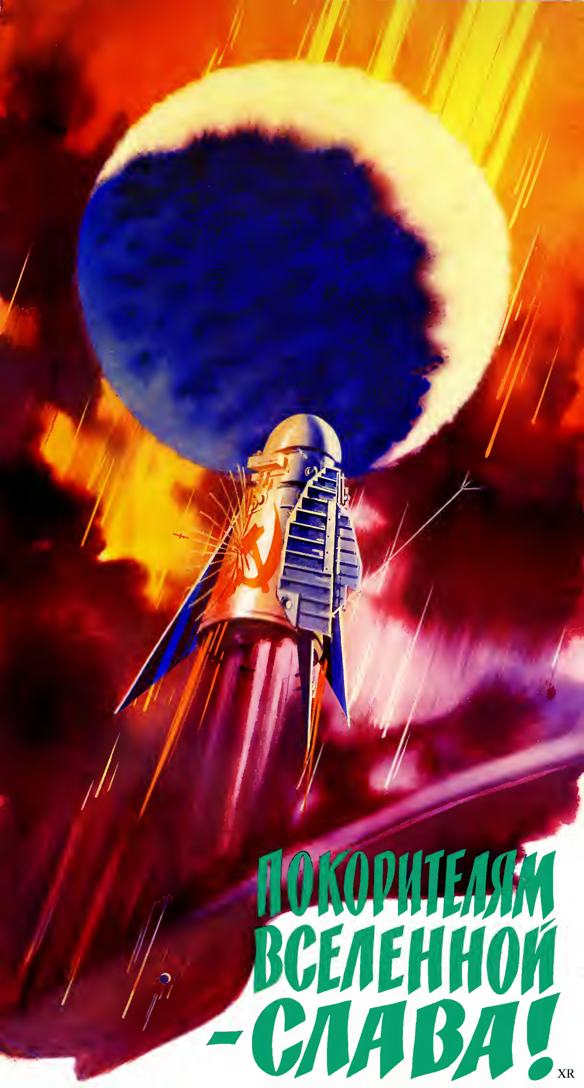
ПОКОРИТЕЛЯМ
ВСЕЛЕННОЙ
- СЛАВА!
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Майор ЮРИЙ АЛЕКСЕЕВИЧ ГАГАРИН
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в истории человечества полет
вокруг земного шара на космическом
корабле-спутнике

СООБЩЕНИЕ ТАСС:

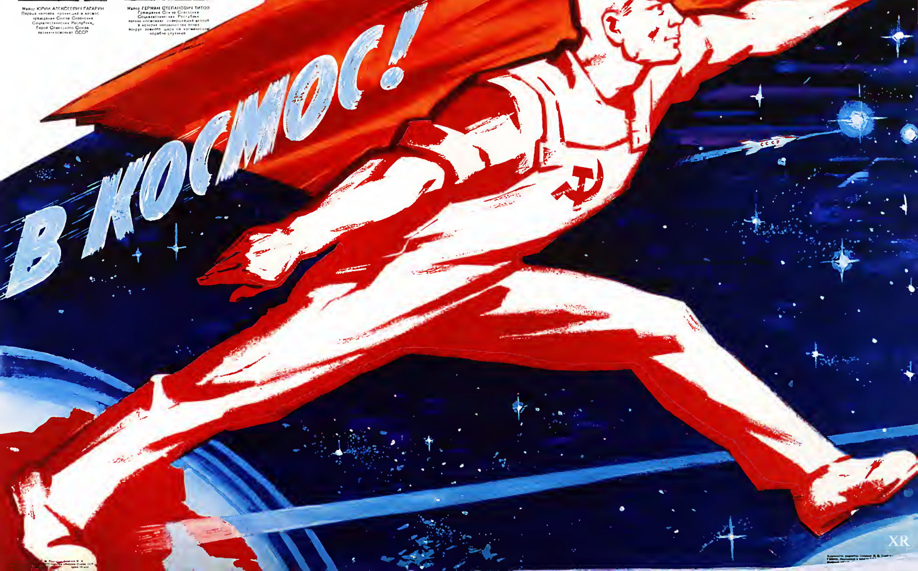
Советский космический корабль-спутник „Восток-2", пилотируемый космонавтом майором ТИТОВЫМ ГЕРМАНОМ СТЕПАНОВИЧЕМ, совершил более 17 оборотов вокруг земного шара в течение 25 часов 18 минут и пролетел свыше 700 тысяч километров.

В связи с успешным завершением программы научных исследований в соответствии с утвержденным полетным заданием была произведена посадка корабля-спутника „Восток-2" в заданном районе Советского Союза вблизи исторического места посадки корабля-спутника „Восток-1" 12 апреля 1961 г. с пилотом-космонавтом майором Юрием Алексеевичем Гагариным.

Товарищ Герман Степанович Титов здоров и чувствует себя отлично.

Беспримерный в истории человечества длительный космический полет советского космонавта успешно завершен.

Полученные результаты исследований открывают широкие перспективы дальнейшего развития космических полетов человека.



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ВОСТОК-2
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ВО СЛАВУ КОММУНИЗМА!

СССР
СССР
СЛАВА ОТЧИЗНЕ ГЕРОЕВ!

miles an hour, only slightly more than the speed of a conventional jet fighter. Ahead, the harsh surface features of the moon are clearly outlined. Behind, the blue-green ball of the earth appears to be barely a yard in diameter.

Our fleet of unpowered rocket ships is now passing the neutral point between the gravitational fields of the earth and the moon. Our momentum has dropped off to almost nothing—yet we're about to pick up speed. For now we begin falling toward the moon, about 23,600 miles away. With no atmosphere to slow us, we'll smash into the moon at 6,000 miles an hour unless we do something about it.

Rotating the Moon Ship

This is what we do: aboard each ship, near its center of gravity, is a positioning device consisting of three flywheels set at right angles to one another and operated by electric motors. One of the wheels heads in the same direction as our flight path—in other words, along the longitudinal axis of the vehicle, like the rear wheels of a car. Another parallels the latitudinal axis, like the steering wheel of an ocean vessel. The third lies along the horizontal axis, like the rear steering wheel of a hook-and-ladder truck. If we start any one of the wheels spinning, it causes our rocket ship to turn slowly in the other direction (pilots know this "torque" effect; as increased power causes a plane's propeller to spin more rapidly in one direction, the pilot has to fight his controls to keep the plane from rolling in the other direction).

The captain of our space ship orders the longitudinal flywheel set in motion. Slowly our craft begins to cartwheel; when it has turned half a revolution, it stops. We are going toward the moon tail-end-first, a position which will enable us to brake our fall with our rocket motors when the right time comes.

Tension increases aboard the three ships. The landing is tricky—so tricky that it will be done entirely by automatic pilot, to diminish the possibility of human error. Our scientists compute our rate of descent, the spot at which we expect to strike, the speed and direction of the moon (it's traveling at 2,280 miles an hour at right angles to our path). These and other essential statistics are fed into a tape. The tape, based on the same principle as the player-piano roll and the automatic business-machine card, will control the automatic pilot. (Actually, a number of tapes intended to provide for all eventualities will be fixed up long before the flight, but last-minute checks are necessary to see which tape to use—and to see whether a manual correction of our course is required before the autopilot takes over.)

Now we lower part of our landing gear—four spiderlike legs, hinged to the square rocket assembly, which have been folded against the framework.

As we near the end of our trip, the gravity of the moon, which is still to one side of us, begins to pull us off our elliptical course, and we turn the ship to conform to this change of direction. At an altitude of 550 miles, the rocket motors begin firing; we feel the shock of their blasts inside the personnel sphere and suddenly our weight returns. Objects which have not been secured beforehand tumble to the floor. The force of the rocket motors is such that we have about one third our normal earth weight.

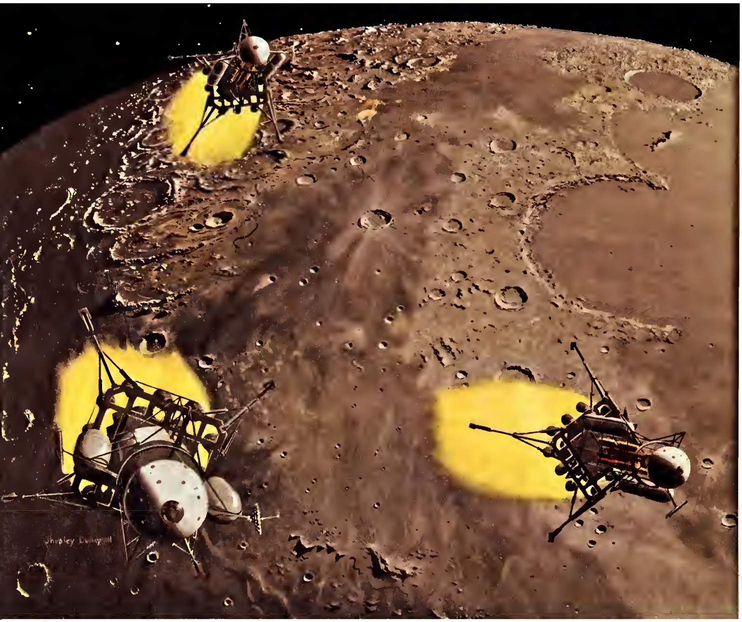
The final 10 minutes are especially tense. The tape-guided automatic pilots are now in full control. We fall more and more slowly, floating over the landing area like descending helicopters. As we approach, the fifth leg of our landing gear—a big telescopic shock absorber which has been housed in the center of the rocket assembly—is lowered through the fiery blast of the motors. The long green rocket flames begin to splash against the naked lunar surface. Swirling clouds of brown-gray dust are thrown out sideways; they settle immediately, instead of hanging in air, as they would on the earth.

The broad round shoe of the telescopic landing leg digs into the soft volcanic ground. If it strikes too hard, an electronic mechanism inside it immediately calls on the rocket motors for more power to cushion the blow. For a few seconds, we balance on the single leg. Then the four outrigger legs slide out to help support the weight of the ship, and are locked into position. The whirring of machinery dies away. There is absolute silence. We have reached the moon.

Now we shall explore it. ▲▲▲

NEXT WEEK

The Exploration of the Moon



Landing on the moon. Ten minutes before touchdown, rocket motors are switched on to slow down ships' high-speed fall caused by the moon's gravity. Vehicles are maneuvering 550 miles above landing area known as *Sinus Roris* (Dewy Bay), dark plain above cargo ship in lower left

blue of the oceans. Patches of white cloud obscure some of the detail; other white blobs are snow and ice on mountain ranges and polar areas.

Against the blackness of the earth's night side is a gleaming spot—the space station, reflecting the light of the sun.

Two hours and 54 minutes after departure, we are 17,750 miles from the earth's surface. Our speed has dropped sharply, to 10,500 miles an hour. Five hours and eight minutes en route, the earth is 32,950 miles away, and our speed is 8,000 miles an hour; after 20 hours, we're 132,000 miles from the earth, traveling at 4,300 miles an hour.

On this first day, we discard the empty departure tanks. Engineers in protective suits step outside the cabin, stand for a moment in space, then make their way down the girders to the big spheres. They pump any remaining propellant into reserve tanks, disconnect the useless containers, and give them a gentle shove. For a while the tanks drift along beside us; soon they float out of sight. Eventually they will crash on the moon.

There is no hazard for the engineers in this operation. As a precaution, they were secured to the ship by safety lines, but they could probably have done as well without them. There is no air in space to blow them away.

That's just one of the peculiarities of space to which we must adapt ourselves. Lacking a natural sequence of night and day, we live by an arbitrary time schedule. Because nothing has weight, cooking and eating are special problems. Kitchen utensils have magnetic strips or clamps so they won't float away. The heating of food is done on electronic ranges. They have many advantages: they're clean, easy to operate, and their short-wave rays don't burn up precious oxygen.

Difficulties of Dining in Space

We have no knives, spoons or forks. All solid food is precut; all liquids are served in plastic bottles and forced directly into the mouth by squeezing. Our mess kits have spring-operated covers; our only eating utensils are tonglike devices; if we open the covers carefully, we can grab a mouthful of food without getting it all over the cabin.

From the start of the trip, the ship's crew has been maintaining a round-the-clock schedule, standing eight-hour watches. Captains, navigators and radiomen spend most of their time checking and rechecking our flight track, ready to start up the rockets for a change in course if an error turns up. Technicians back up this operation with reports from the complex and delicate "electronic brains"—computers, gyroscopes, switchboards and other instruments—on the control deck. Other specialists keep watch over the air-conditioning, temperature, pressure and oxygen systems.

But the busiest crew members are the maintenance engineers and their assistants, tireless men who have been bustling back and forth between ships since shortly after the voyage started, anxiously checking propellant tanks, tubing, rocket motors, turbopumps and all other vital equipment. Excessive heat could cause dangerous hairline cracks in the rocket motors; unexpectedly large meteors could smash through the thin bumpers surrounding the propellant tanks; fittings could come loose. The engineers have to be careful.

We are still slowing down. At the start of the fourth day, our speed has dropped to 800

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to run the turbopumps which force the propellant into the rocket motors. Besides the 14 cylindrical propellant tanks and the four spherical ones, eight small helium containers are strung throughout the framework. The lighter-than-air helium will be pumped into partly emptied fuel tanks to help them keep their shape under acceleration and to create pressure for the turbopumps.

The cost of the propellant required for this first trip to the moon, the bulk of it used for the supply ships during the build-up period, is enormous—about $300,000,000, roughly 60 per cent of the half-billion-dollar cost of the entire operation. (That doesn't count the $4,000,000,000 cost of erecting the space station, whose main purpose is strategic rather than scientific.)

The cargo ship carries only enough fuel for a one-way trip, so it has fewer tanks: four discardable spheres like those on the passenger craft, and four cylindrical containers with 162,000 gallons of propellant for the moon landing.

In one respect, the cargo carrier is the most interesting of the three space vehicles. Its big silo-like storage cabin, 75 feet long and 36 feet wide, was built to serve a double purpose. Once we reach the moon and the big cranes folded against the framework have swung out and unloaded the 285 tons of supplies in the cylinder, the silo will be detached from the rest of the rocket ship. The winch-driven cables slung from the cranes will then raise *half* of the cylinder, in sections, which it will deposit on trailers drawn by tractors. The tractors will take them to a protective crevice on the moon's surface, at the place chosen for our camp. Then the other lengthwise half will be similarly moved—giving us two ready-to-use Quonset huts.

Now that we have our space ships built and have provided ourselves with living quarters for our stay on the moon, a couple of important items remain: we must protect ourselves against two of the principal hazards of space travel, flying meteors and extreme temperatures.

For Protection Against Meteors

To guard against meteors, all vital parts of the three craft—propellant tanks, personnel spheres, cargo cabin—are given a thin covering of sheet metal, set on studs which leave at least a one-inch space between this outer shield and the inside wall. The covering, called a meteor bumper, will take the full impact of the flying particles (we don't expect to be struck by any meteors much larger than a grain of sand) and will cause them to disintegrate before they can do damage.

For protection against excessive heat, all parts of the three rocket ships are painted white, because white absorbs little of the sun's radiation. Then, to guard against cold, small black patches are scattered over the tanks and personnel spheres. The patches are covered by white blinds, automatically controlled by thermostats. When the blinds on the sunny side are open, the spots absorb heat and warm the cabins and tanks; when the blinds are closed, an all-white surface is exposed to the sun, permitting little heat to enter. When the blinds on the shaded side are open, the black spots radiate heat and the temperature drops.

Now we're ready to take off from the space station's orbit to the moon.

The bustle of our departure—hurrying space taxis, the nervous last-minute checks by engineers, the loading of late cargo and finally the take-off itself—will be watched by millions. Television cameras on the space station will transmit the scene to receivers all over the world. And people on the earth's dark side will be able to turn from their screens to catch a fleeting glimpse of light—high in the heavens—the combined flash of 90 rocket motors, looking from the earth like the sudden birth of a new, short-lived star.

Our departure is slow. The big rocket ships rise ponderously, one after the other, green flames streaming from their batteries of rockets, and then they pick up speed. Actually, we don't need to gain *much* speed. The velocity required to get us to our destination is 19,500 miles an hour, but we've had a running start; while "resting" in the space station's orbit, we were really streaking through space at 15,840 miles an hour. We need an additional 3,660 miles an hour.

Thirty-three minutes from take-off we have it. Now we cut off our motors; momentum and the moon's gravity will do the rest.

The moon itself is visible to us as we coast through space, but it's so far off to one side that it's hard to believe we won't miss it. In the five days of our journey, though, it will travel a great distance, and so will we; at the end of that time we shall reach the farthest point, or apogee, of our elliptical course, and the moon should be right in front of us.

The earth is visible, too—an enormous ball, most of it bulking pale black against the deeper black of space, but with a wide crescent of daylight where the sun strikes it. Within the crescent, the continents enjoying summer stand out as vast green terrain maps surrounded by the brilliant

Inside the Moon Ship

By WILLY LEY

ABOARD the moon ships, living is cramped, but not uncomfortable. Each of the two passenger vehicles holds 20 men en route to the moon, 25 on the return trip (the 10 men on the one-way cargo ship will split up coming back). For added safety, each passenger ship carries enough oxygen (three pounds per man per day), water (four pounds per man per day) and food for the *entire* expedition.

The top floor of the personnel sphere is the control deck. At the far left, an engineer keeps watch over fuel, temperature, pressure, oxygen and other gauges. Next to him, the radio operator maintains contact with the other two ships and the space station. At center, a member of the navigation staff, using a combination telescope-celestial camera, sights on a star. (When not in use, astrodomes are closed off by shutters to block the sun's blinding glare.)

To the right of his position is the rocket motor instrument panel and, underneath, the automatic pilot and the reels of tape which operate it during landing. The man at extreme right is the crew captain, strapped into a swivel seat which enables him to watch either the master controls, as he's doing now, or the motor instruments behind him (for comfort, all seats are contour seats; personnel must be strapped in so they won't float away in the weightless ship). A control board at the captain's position enables him to operate the rocket motors, and the intercom unit by his hand keeps him in communication with the rest of the ship.

The next floor down is primarily a navigation deck, although a sponge-bath stall (there are no showers, because the water won't fall properly) and extra bunks are also installed here. Next to the bathing stall, a navigator operates a mechanical computer. The chief navigator and two assistants are working at the dead-reckoning tracer, a device which automatically records the space ship's course. The clock on the wall shows elapsed time since departure, and the three screens at the right indicate the attitude of the ship, as determined by an artificial horizon mechanism in the astrodome at far right.

On the central, and largest, deck are the ship's living quarters. Bunks line the walls and hang from stanchions (the sleeping men are members of the off-duty watch), and a cooking-dining area occupies most of the floor space. At center is an automatic dining unit: table, short-wave food heater and dishwasher.

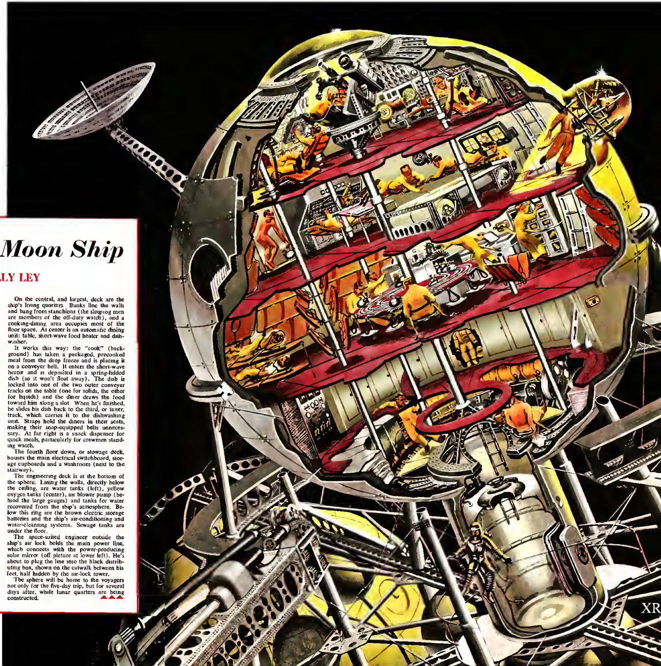
It works this way: the "cook" (background) has taken a packaged, precooked meal from the deep freeze and is placing it on a conveyer belt. It enters the short-wave heater and is deposited in a spring-lidded dish (so it won't float away). The dish is locked into one of the two outer conveyer tracks on the table (one for solids, the other for liquids) and the diner draws the food toward him along a slot. When he's finished, he slides his dish back to the third, or inner, track, which carries it to the dishwashing unit. Straps hold the diners in their seats, making their snap-equipped belts unnecessary. At far right is a snack dispenser for quick meals, particularly for crewmen standing watch.

The fourth floor down, or stowage deck, houses the main electrical switchboard, storage cupboards and a washroom (next to the stairway).

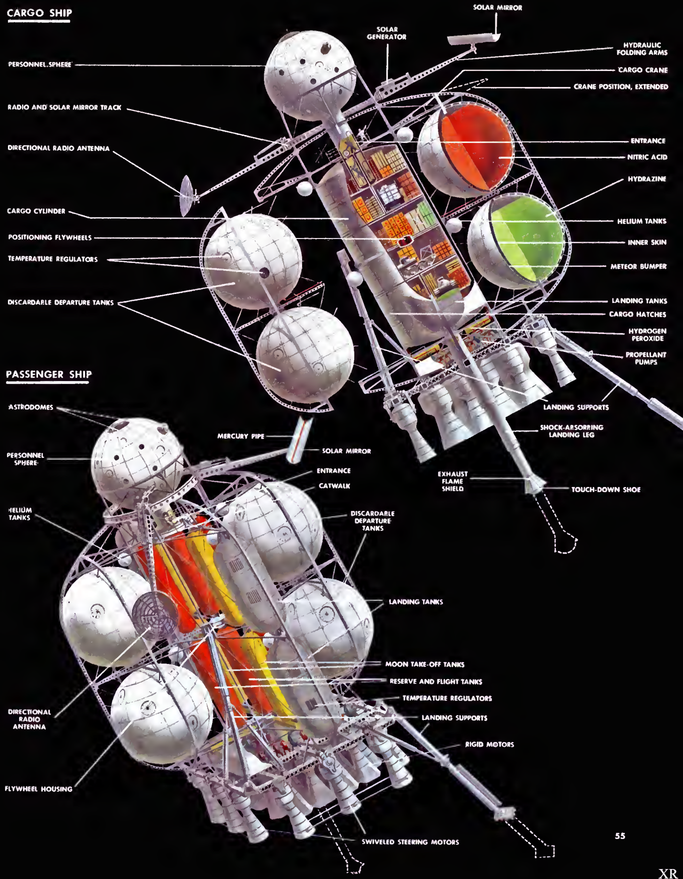
The engineering deck is at the bottom of the sphere. Lining the walls, directly below the ceiling, are water tanks (left), yellow oxygen tanks (center), air blower pump (behind the large gauges) and tanks for water recovered from the ship's atmosphere. Below this ring are the brown electric storage batteries and the ship's air-conditioning and water-cleansing systems. Sewage tanks are under the floor.

The space-suited engineer outside the ship's air lock holds the main power line, which connects with the power-producing solar mirror (off picture at lower left). He's about to plug the line into the black distributing box, shown on the catwalk between his feet, half hidden by the air-lock tower.

The sphere will be home to the voyagers not only for the five-day trip, but for several days after, while lunar quarters are being constructed. ▲▲▲



ILLUSTRATED BY FRED FREEMAN



CARGO SHIP

PASSENGER SHIP

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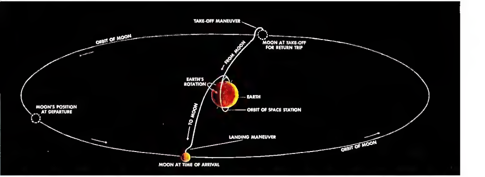
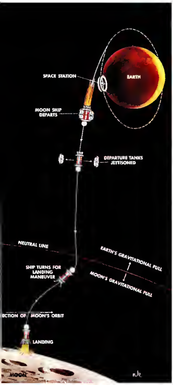


Diagram above shows flight paths to and from moon. Moving in elliptical course about globe every 27⅓ days, moon's position lines up with space station's orbit once every two weeks. Trips can be made only at this time. During expedition's six-week stay on lunar surface, moon will make 1½ revolutions around earth to reach correct position for return. Slight curves in flight track during landing and take-off are caused by moon's gravity. Drawing below, not in scale, shows moon-bound flight maneuvers in close-up


SPACE STATION
EARTH
MOON SHIP DEPARTS
DEPARTURE TANKS JETTISONED
NEUTRAL LINE
EARTH'S GRAVITATIONAL PULL
MOON'S GRAVITATIONAL PULL
SHIP TURNS FOR LANDING MANEUVER
ECTION OF MOON'S ORBIT
LANDING
MOON
RJK

in. With a satisfactory site located, we start our detailed planning.

To save fuel and time, we want to take the shortest practical course. The moon moves around the earth in an elliptical path once every 27⅓ days. The space station, our point of departure, circles the earth once every two hours. Every two weeks, their paths are such that a rocket ship from the space station will intercept the moon in just five days. The best conditions for the return trip will occur two weeks later, and again two weeks after that. With their stay limited to multiples of two weeks, our scientists have set themselves a six-week limit for the first exploration of the moon—long enough to accomplish some constructive research, but not long enough to require a prohibitive supply of essentials like liquid oxygen, water and food.

Six months before our scheduled take-off, we begin piling up construction materials, supplies and equipment at the space station. This operation is a massive, impressive one, involving huge, shuttling cargo rocket ships, scores of hard-working handlers, and tremendous amounts of equipment. Twice a day, pairs of sleek rocket transports from the earth sweep into the satellite's orbit and swarms of workers unload the 36 tons of cargo each carries. With the arrival of the first shipment of material, work on the first of the three moon-going space craft gets under way, picking up intensity as more and more equipment arrives.

The supplies are not stacked inside the space station; they're just left floating in space. They don't have to be secured, and here's why: the satellite is traveling around the earth at 15,840 miles an hour; at that speed, it can't be affected by the earth's gravity, so it doesn't fall, and it never slows down because there's no air resistance. The same applies to any other object brought into the orbit at the same speed: to park beside the space station, a rocket ship merely adjusts its speed to 15,840 miles per hour; and it, too, becomes a satellite. Crates moved out of its hold are traveling at the same speed in relation to the earth, so they also are weightless satellites.

As the weeks pass and the unloading of cargo ships continues, the construction area covers several littered square miles. Tons of equipment lie about—aluminum girders, collapsed nylon-and-plastic fuel tanks, rocket motor units, turbopumps, bundles of thin aluminum plates, a great many nylon bags containing smaller parts. It's a bewildering scene, but not to the moon-ship builders. All construction parts are color-coded—with blue-tipped cross braces fitting into blue sockets, red joining members keyed to others of the same color, and so forth. Work proceeds swiftly.

In fact, the workers accomplish wonders, considering the obstacles confronting a man forced to struggle with unwieldy objects in space. The men move clumsily, hampered by bulky pressurized suits equipped with such necessities of space-life as air conditioning, oxygen tanks, walkie-talkie radios and tiny rocket motors for propulsion. The work is laborious, for although objects are weightless they still have inertia. A man who shoves a one-ton girder makes it move all right, but he makes himself move, too. As his inertia is less than the girder's, he shoots backward much farther than he pushes the big piece of metal forward.

The small personal rocket motors help the workers move some of the construction parts; the big stuff is hitched to space taxis, tiny pressurized rocket vehicles used for short trips outside the space station.

As the framework of the new rocket ships takes form, big, folded nylon-and-plastic bundles are brought over. They're the personnel cabins; pumped full of air, they become spherical, and plastic astrodomes are fitted to the top and sides of each. Other sacks are pumped full of propellant, and balloon into the shapes of globes and cylinders. Soon the three moon-going space ships begin to emerge in their final form. The two round-trip ships resemble an arrangement of hourglasses inside a metal framework, the one-way cargo carrier has much the same framework, but instead of hourglasses it has a central structure which looks like a great silo.

Dimensions of the Rocket Ships

Each ship is 160 feet long (nine feet more than the height of the Statue of Liberty) and about 110 feet wide. Each has at its base a battery of 30 rocket motors, and each is topped by the sphere which houses the crew members, scientists and technicians on five floors. Under the sphere are two long arms set on a circular track which enables them to rotate almost a full 360 degrees. These light booms, which fold against the vehicles during take-off and landing to avoid damage, carry two vital pieces of equipment: a radio antenna dish for short-wave communication and a solar mirror for generating power.

The solar mirror is a curved sheet of highly polished metal which concentrates the sun's rays on a mercury-filled pipe. The intense heat vaporizes the mercury, and the vapor drives a turbo-generator, producing 35 kilowatts of electric power—enough to run a small factory. Its work done, the vapor cools, returns to its liquid state and starts the cycle all over again.

Under the radio and mirror booms of the passenger ships hang 18 propellant tanks carrying nearly 800,000 gallons of ammonialike hydrazine (our fuel) and oxygen-rich nitric acid (the combustion agent). Four of the 18 tanks are outsized spheres, more than 33 feet in diameter. They are attached to light frames on the outside of the rocket ship's structure. More than half our propellant supply—580,000 gallons—is in these large balls, that's the amount needed for take-off. As soon as it's exhausted, the big tanks will be jettisoned. Four other large tanks carry propellant for the landing; they will be left on the moon.

We also carry a supply of hydrogen peroxide

Vehicles, right, have same dimensions: 160 ft. long, 110 ft. wide; weigh 4,370 tons. Cargo ship carries 10 men, passenger ships 20 each

DRAWINGS BY ROLF KLEP

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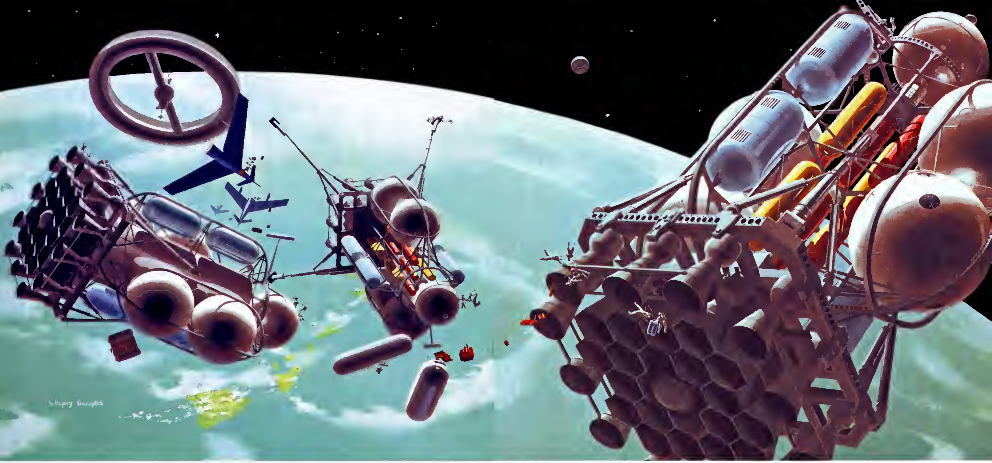

Weightless in orbit 1,075 miles above earth, workers in space suits assemble three moon ships. Hawaiian Islands lie below. Winged transports unload supplies near wheel-shaped space station top left. Engineers and equipment cluster around cargo ship lower left, passenger ships center and right

Man on the Moon

THE JOURNEY

By DR. WERNHER von BRAUN

Technical Director, Army Ordnance Guided Missiles Development
Group, Redstone Arsenal, Huntsville, Alabama

For five days, the expedition speeds through space on its historic voyage —50 men on three ungainly craft, bound for the great unknown

HERE is how we shall go to the moon. The pioneer expedition, 50 scientists and technicians, will take off from the space station's orbit in three clumsy-looking but highly efficient rocket ships. They won't be streamlined: all travel will be in space, where there is no air to impede motion. Two will be loaded with propellant for the five-day, 239,000-mile trip and the return journey. The third, which will not return, will carry only enough propellant for a one-way trip; the extra room will be filled with supplies and equipment for the scientists' six-week stay.

On the outward voyage, the rocket ships will hit a top speed of 19,500 miles per hour about 33 minutes after departure. Then the motors will be stopped, and the ships will fall the rest of the way to the moon.

Such a trip takes a great deal of planning. For a beginning, we must decide what flight path to follow, how to construct the ships and where to land. But the project could be completed within the next 25 years. There are no problems involved to which we don't have the answers—or the ability to find them—right now.

First, where shall we land? We may have a wide choice, once we have had a close look at the moon. We'll get that look on a preliminary survey flight. A small rocket ship taking off from the space station will take us to within 50 miles of the moon to get pictures of its meteor-pitted surface—including the "back" part, never visible from the earth.

We'll study the photographs for a suitable site. Several considerations limit our selection. Because the moon's surface has 14,600,000 square miles—about one thirteenth that of the earth—we won't be able to explore more than a small area in detail, perhaps part of a section 500 miles in diameter. Our scientists want to see as many kinds of lunar features as possible, so we'll pick a spot of particular interest to them. We want radio contact with the earth, too; that means we'll have to stick to the moon's "face," for radio waves won't reach across space to any point the eye won't reach.

We can't land at the moon's equator because its noonday temperatures reach an unbearable 220-degrees Fahrenheit, more than hot enough to boil water. We can't land where the surface is too rugged, because we need a flat place to set down. Yet the site can't be too flat, either—grain-sized meteors constantly bombard the moon at speeds of several miles a second; we'll have to set up camp in a crevice where we have protection from these bullets.

There's one section of the moon that meets all our requirements, and unless something better turns up on closer inspection, that's where we'll land. It's an area called *Sinus Roris*, or Dewy Bay, on the northern branch of a plain known as *Oceanus Procellarum*, or Stormy Ocean (so called by early astronomers who thought the moon's plains were great seas). Dr. Fred L. Whipple, chairman of Harvard University astronomy department, says *Sinus Roris* is ideal for our purpose—about 650 miles from the lunar north pole, where the daytime temperature averages a reasonably pleasant 40 degrees and the terrain is flat enough to land on, yet irregular enough to hide

PAINTING BY CHESLEY BONESTELL

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MAN on the MOON

Scientists have dreamed for centuries of a lunar voyage. Now we know it can be done within the next 25 years—if we get started right away. In this symposium, a distinguished panel tells how

WE WILL go to the moon in the next 25 years. We have the knowledge and the tools to do it now, but years of preparation and detailed planning are needed first. What we *can* do now is get the project started.

The first step has been taken: our scientists have developed rockets which have shot through the earth's atmosphere into airless space beyond. All we need now are better rockets—and we know how to build them.

Our trip to the moon will not be a simple nonstop flight from the earth. We'd need too large and expensive a rocket ship for that. Instead, we'll make a stopover in space. We'll change vehicles, shifting from one especially designed to break away from the earth's atmosphere into one specifically designed for a moon voyage. There will be other advantages to a two-step trip, too, among them a 15,840-mile-an-hour running start on the second leg of the journey. Here's how it's done:

Within the next 10 or 15 years, we can expect to see a permanent station erected in space, 1,075 miles high, in an orbit which will carry it around the earth once every two hours. The details of this project were given in Collier's issue of March 22, 1952.

The station will be built of materials carried to the two-hour orbit by great rocket ships—called three-stage rockets because they will have three separate batteries of motors to be used one at a time, then dropped off. At a speed of 15,840 miles an hour, 1,075 miles up, these rockets become satellites of the earth, unaffected by gravity. Without power, they will cruise around the globe as long as we let them. Their cargo will do the same, since it travels at the same speed. So we merely unload our building supplies in space and let them drift there until needed.

From these prefabricated parts, we'll build a wheel-shaped structure 250 feet in diameter, with pressurized compartments and a crew of 80. The space station's ability to scan all parts of the earth will make it one of the most powerful forces for peace ever developed—or, in the wrong hands, a terrible weapon of war. Collier's still believes that the station must be built by free men; that means the United States, the only nation which can afford the satellite's $4,000,000,000 cost. In 1948, the late Secretary of Defense James V. Forrestal indicated that work on an earth satellite program had already begun. It should not be allowed to lag.

For, besides serving as a roving, ever-watchful guardian of the peace, the station in space will provide the springboard for one of the greatest scientific advances in history: the lunar journey men have dreamed of for centuries. The space station should be a reality by 1967. By the time it's completed, many of the preliminary plans will be ready for the next long step into space.

By 1977, the first scientists may set foot on the ancient dust of the moon.

HANS KNOPF

Contributors to symposium: Willy Ley, left, writer on scientific subjects; Dr. Fred L. Whipple, chairman of Harvard University astronomy department; Dr. Wernher von Braun, world's top rocket expert; artists Chesley Bonestell, Rolf Klep, Fred Freeman; associate editor Cornelius Ryan, who assembled material

MOON PHOTO COURTESY LICK OBSERVATORY

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OCTOBER 18, 1952 • FIFTEEN CENTS

MAN ON THE MOON

Scientists Tell How
We Can Land There
In Our Lifetime

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Space Rockets

TO PUNCH OUT AND ASSEMBLE

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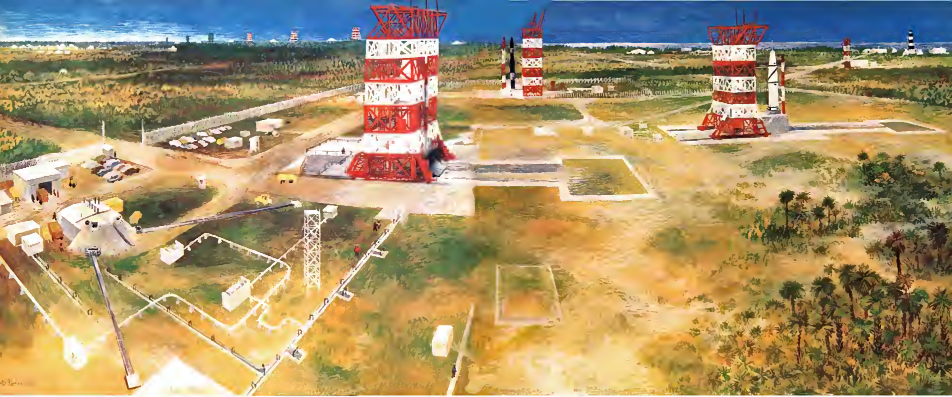

The missile towers of Canaveral rise above a sandspit 150 miles south of Jacksonville and look out to all the continents and up to space. Three years ago this was a wasteland of scrub, inhabited by contented rattlesnakes and alligators. Dominating the center of the new landscape is a Thor tower, or gantry, 100 feet tall. This is a self-propelled work platform, of eight levels, served by an elevator, and formed of steel girders. While a Thor is being prepared for launch, it stands enclosed in the tower (as shown in the painting) and the technicians can deal with its internal mechanisms. When it is ready for launch, the tower draws back, as shown on the right, leaving the missile on its launch pad. Between the Thor towers is a Vanguard rocket, the Navy's satellite carrier, alongside a simpler tower. The graceful shape in the far right is not a rocket but the Cape Canaveral Lighthouse, which was there long before the missiles. In the far distance are squat towers that service the Atlas and Titan ICBM's. They stand in a row, about half a mile apart. In the left foreground is a complex that serves the Thor—the blockhouse, maintenance shops, tanks for the kerosene and liquid oxygen that fuel the missile, and the metal lines through which the propellants are pumped to the launch pad.

Paintings by Bernard Perlin

The Countdown at Canaveral

by Charles J. V. Murphy

On a Florida sandspit the aircraft primes and the electronics companies have joined with the military in an extraordinary partnership. Here is an account of their collaboration at its most dramatic moment.

"The peculiar thing about my job," young Mr. Gordon was saying, "is that it was a job in which no previous experience was demanded for the simple reason that nobody else could claim any, at least where the big birds were concerned." Not only was Theodore Gordon's specialty unusual; so was the setting in which he was practicing it. His "desk" was something he called a console—an instrument panel with a horizontal row of red and green lights, and under the lights such legends as "launch control," "guidance control," "warhead control," and "pad safety." His "office" was a cluttered room in a concrete blockhouse, with steel-reinforced concrete walls two feet thick, and further protected, on the side where Mr. Gordon's professional responsibilities chiefly lay, by a sand revetment twenty feet thick. This massive carapace was to protect Gordon and his fellow technicians from the consequences of certain improbable, but by no means impossible, mishaps.

Slightly more than 200 yards away, visible to Gordon only on a television screen placed over another console close

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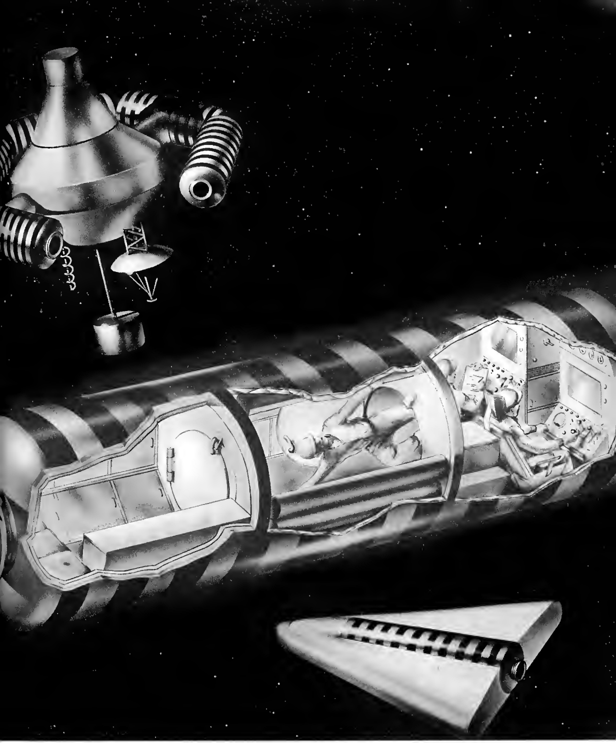

In weightless space flight, component of space station approaches its destination. Winged component prepares for re-entry into earth's atmosphere.

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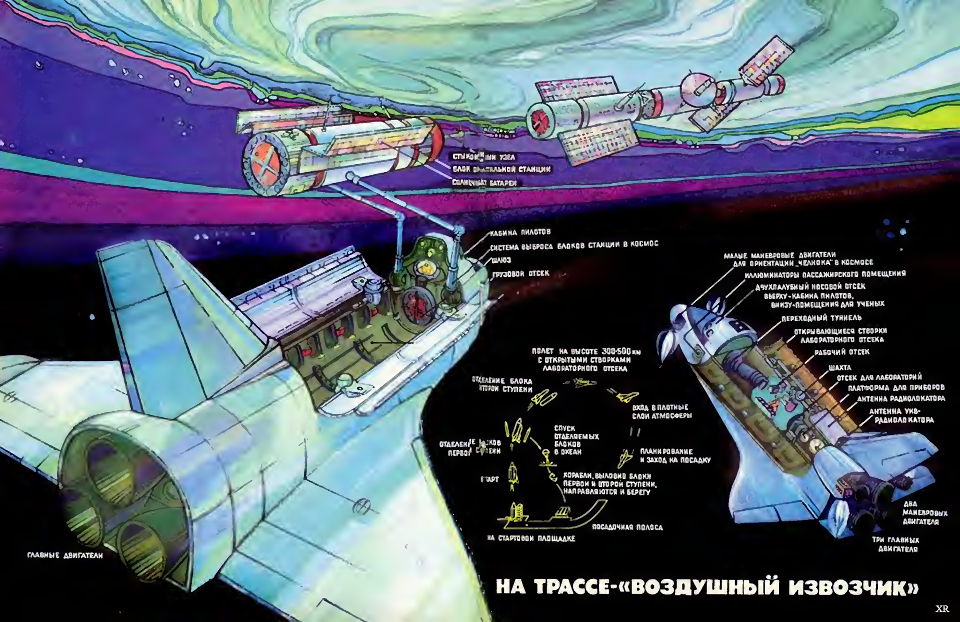
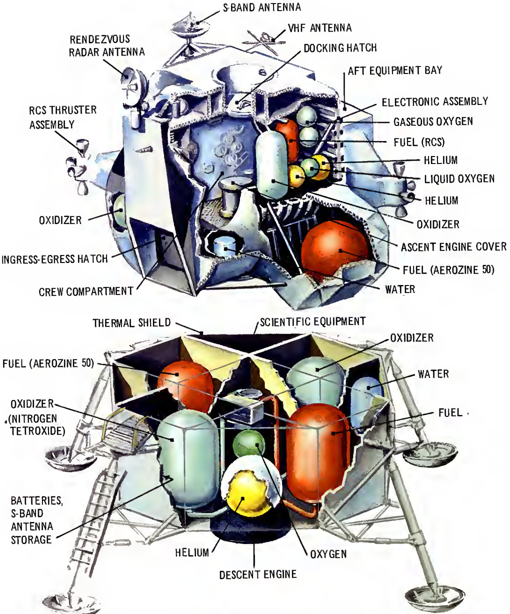

СТЫКОВОЧНЫЙ УЗЕЛ
БЛОК ОРБИТАЛЬНОЙ СТАНЦИИ
СОЛНЕЧНЫЕ БАТАРЕИ
КАБИНА ПИЛОТОВ
СИСТЕМА ВЫБРОСА БЛОКОВ СТАНЦИИ В КОСМОС
ШЛЮЗ
ГРУЗОВОЙ ОТСЕК
ГЛАВНЫЕ ДВИГАТЕЛИ
ПОЛЕТ НА ВЫСОТЕ 300-500 км С ОТКРЫТЫМИ СТВОРКАМИ ЛАБОРАТОРНОГО ОТСЕКА
ОТДЕЛЕНИЕ БЛОКА ВТОРОЙ СТУПЕНИ
ВХОД В ПЛОТНЫЕ СЛОИ АТМОСФЕРЫ
ОТДЕЛЕНИЕ БЛОКОВ ПЕРВОЙ СТУПЕНИ
СПУСК ОТДЕЛЯЕМЫХ БЛОКОВ В ОКЕАН
ПЛАНИРОВАНИЕ И ЗАХОД НА ПОСАДКУ
СТАРТ
КОРАБЛИ, ВЫЛОВИВ БЛОКИ ПЕРВОЙ И ВТОРОЙ СТУПЕНИ, НАПРАВЛЯЮТСЯ К БЕРЕГУ
ПОСАДОЧНАЯ ПОЛОСА
НА СТАРТОВОЙ ПЛОЩАДКЕ
МАЛЫЕ МАНЕВРОВЫЕ ДВИГАТЕЛИ ДЛЯ ОРИЕНТАЦИИ „ЧЕЛНОКА" В КОСМОСЕ
ИЛЛЮМИНАТОРЫ ПАССАЖИРСКОГО ПОМЕЩЕНИЯ
ДВУХПАЛУБНЫЙ НОСОВОЙ ОТСЕК ВВЕРХУ-КАБИНА ПИЛОТОВ, ВНИЗУ-ПОМЕЩЕНИЯ ДЛЯ УЧЕНЫХ
ПЕРЕХОДНЫЙ ТУННЕЛЬ
ОТКРЫВАЮЩИЕСЯ СТВОРКИ ЛАБОРАТОРНОГО ОТСЕКА
РАБОЧИЙ ОТСЕК
ШАХТА
ОТСЕК ДЛЯ ЛАБОРАТОРИЙ
ПЛАТФОРМА ДЛЯ ПРИБОРОВ
АНТЕННА РАДИОЛОКАТОРА
АНТЕННА УКВ-РАДИОЛОКАТОРА
ДВА МАНЕВРОВЫХ ДВИГАТЕЛЯ
ТРИ ГЛАВНЫХ ДВИГАТЕЛЯ

НА ТРАССЕ-«ВОЗДУШНЫЙ ИЗВОЗЧИК»



LUNAR MODULE

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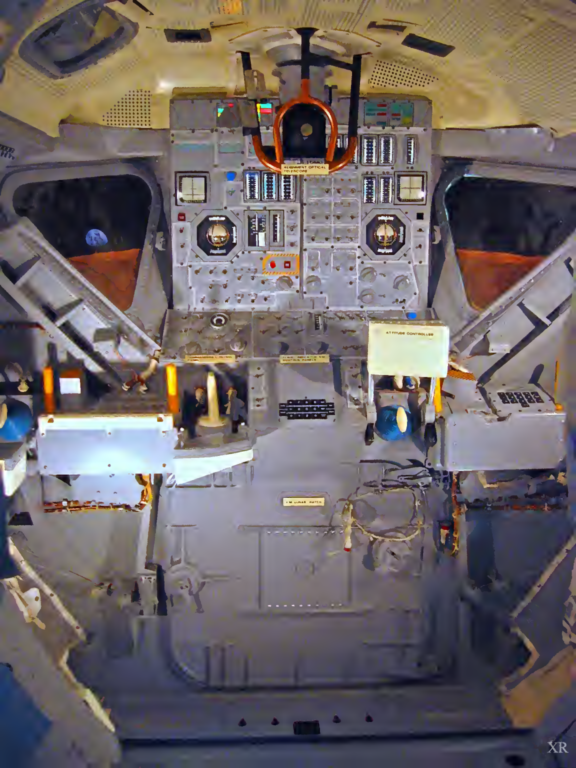
ALIGNMENT OPTICAL TELESCOPE
ATTITUDE CONTROLLER
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UNITED STATES
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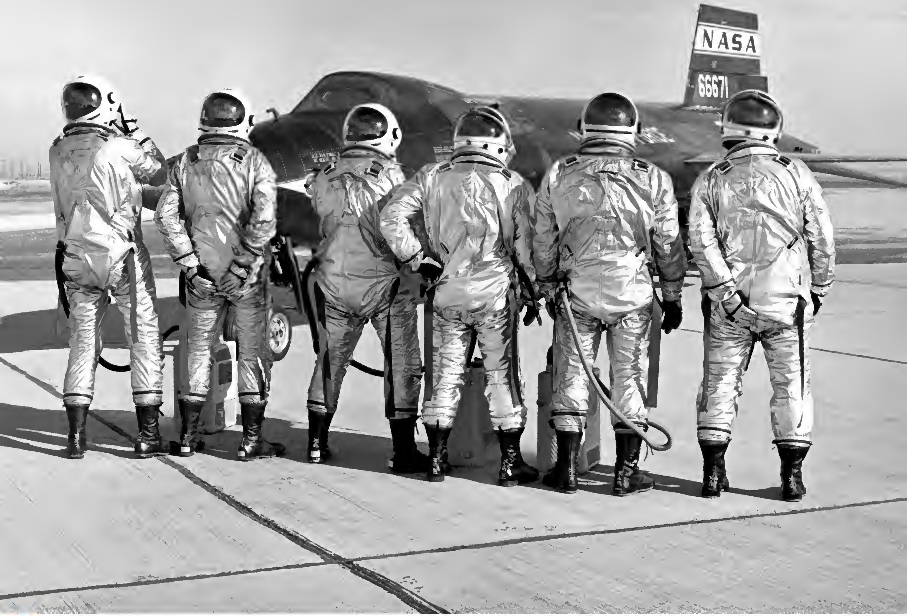

NASA Dryden Flight Research Center Photo Collection
http://www.dfrc.nasa.gov/Gallery/Photo/index.html
NASA Photo: E-14182 Date: 1966

X-15 test pilots – in a lighter mood

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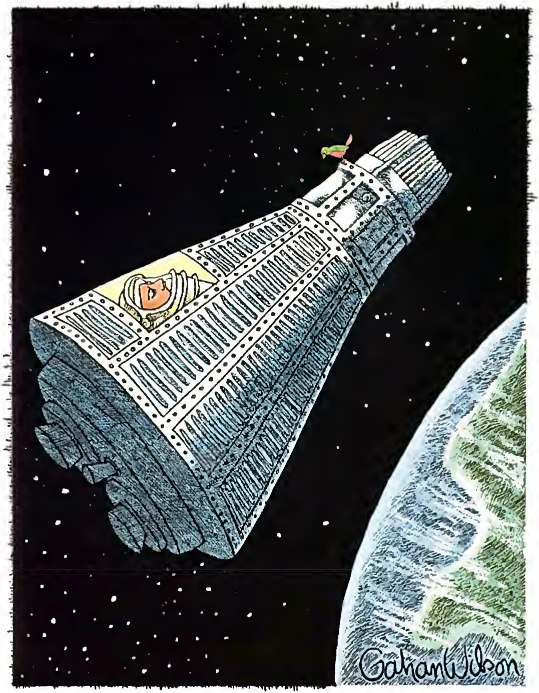

"I'm only guessing, but I think it's a red-tailed warbler . . ."

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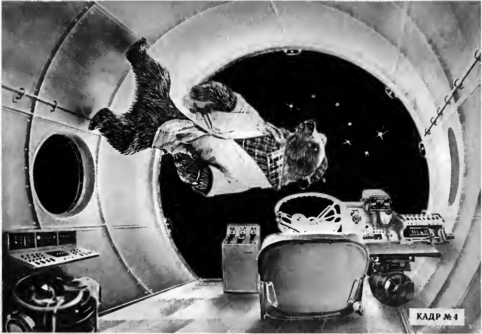

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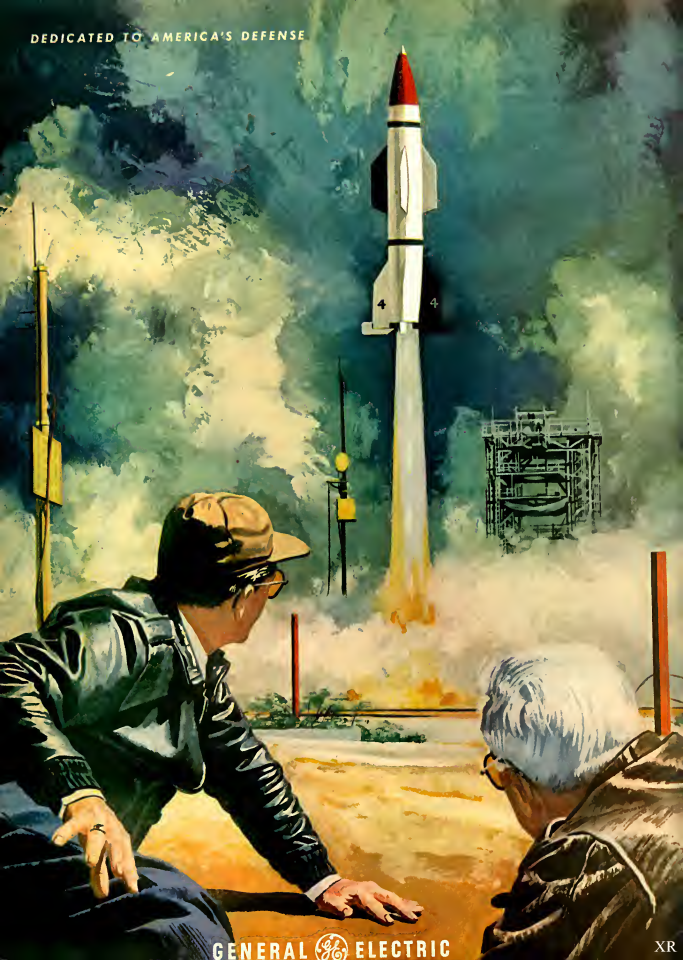
DEDICATED TO AMERICA'S DEFENSE
4
4
GENERAL GE ELECTRIC
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This silent morning, on Space Shuttle #28, breakfast will probably begin with Tang.™

Imagine a spaceship that carries 12 passengers and lands as easily as an airplane. It will be ferrying back and forth to space by the late 1970's.

And if the future is like the present, Tang will be in its galley. Just as it's on your kitchen table.

Nutritious, orange-flavored Tang. The instant breakfast drink with more Vitamin C than orange juice.

No matter where you are.

Tang. For spacemen. And earth families.

TANG IS GENERAL FOODS TRADEMARK FOR INSTANT BREAKFAST DRINK.

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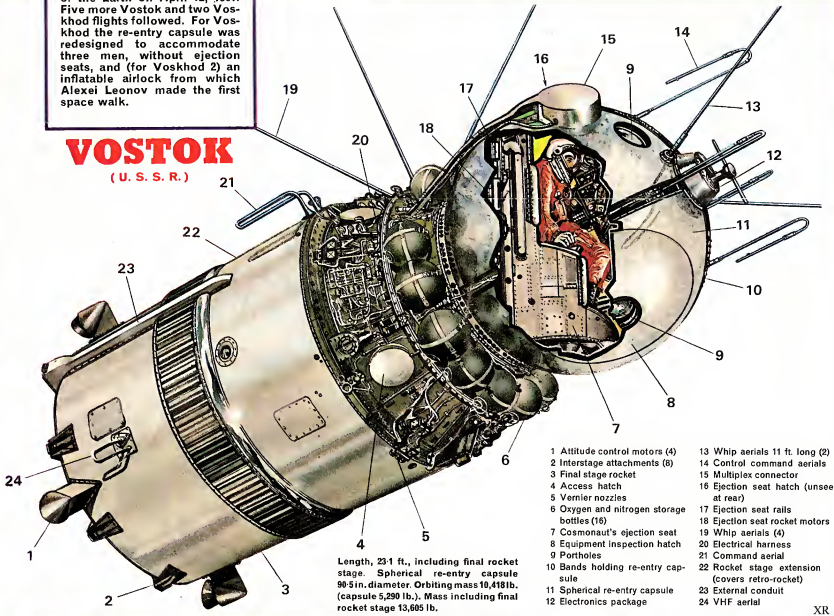
Manned Spacecraft

Vostok was the first manned spacecraft, carrying Flight Major Yuri Gagarin for one orbit of the Earth on April 12, 1961. Five more Vostok and two Voskhod flights followed. For Voskhod the re-entry capsule was redesigned to accommodate three men, without ejection seats, and (for Voskhod 2) an inflatable airlock from which Alexei Leonov made the first space walk.

VOSTOK

(U. S. S. R.)



Length, 23·1 ft., including final rocket stage. Spherical re-entry capsule 90·5 in. diameter. Orbiting mass 10,418 lb. (capsule 5,290 lb.). Mass including final rocket stage 13,605 lb.

1 Attitude control motors (4)
2 Interstage attachments (8)
3 Final stage rocket
4 Access hatch
5 Vernier nozzles
6 Oxygen and nitrogen storage bottles (16)
7 Cosmonaut's ejection seat
8 Equipment inspection hatch
9 Portholes
10 Bands holding re-entry capsule
11 Spherical re-entry capsule
12 Electronics package
13 Whip aerials 11 ft. long (2)
14 Control command aerials
15 Multiplex connector
16 Ejection seat hatch (unseen at rear)
17 Ejection seat rails
18 Ejection seat rocket motors
19 Whip aerials (4)
20 Electrical harness
21 Command aerial
22 Rocket stage extension (covers retro-rocket)
23 External conduit
24 VHF aerial

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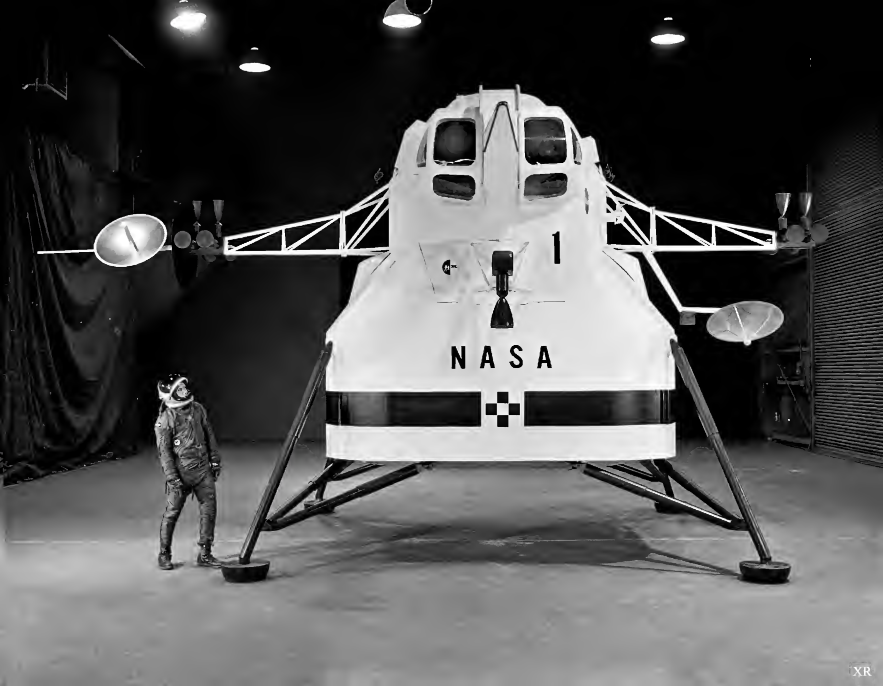
Reproduced from Manned Spacecraft by Kenneth Gatland, published at £1·15 by Blandford Press Limited



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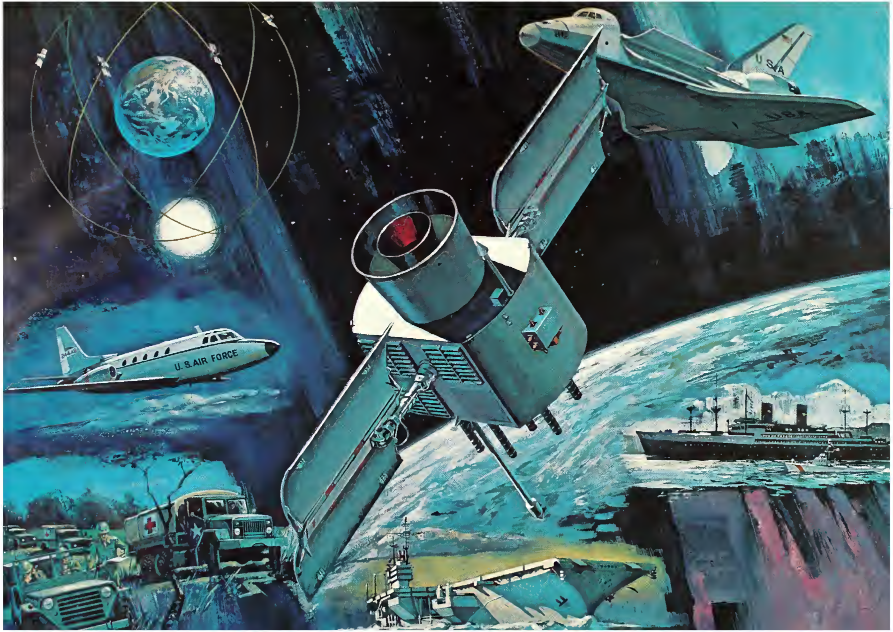

Providing continuous global coverage in all weather, the NAVSTAR Global Positioning System will give suitably equipped users three-dimensional position and velocity information and a precise timing reference in real time. Besides routine navigation, possible applications include search-and-rescue operations, land and aerial rendezvous, and geodetic surveys.

Rockwell International
Space Division

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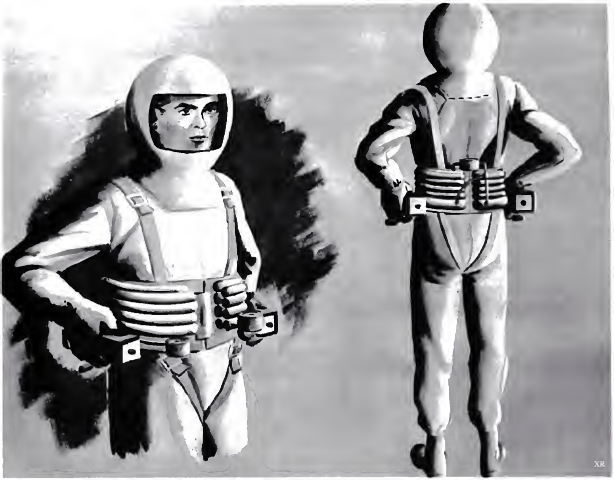
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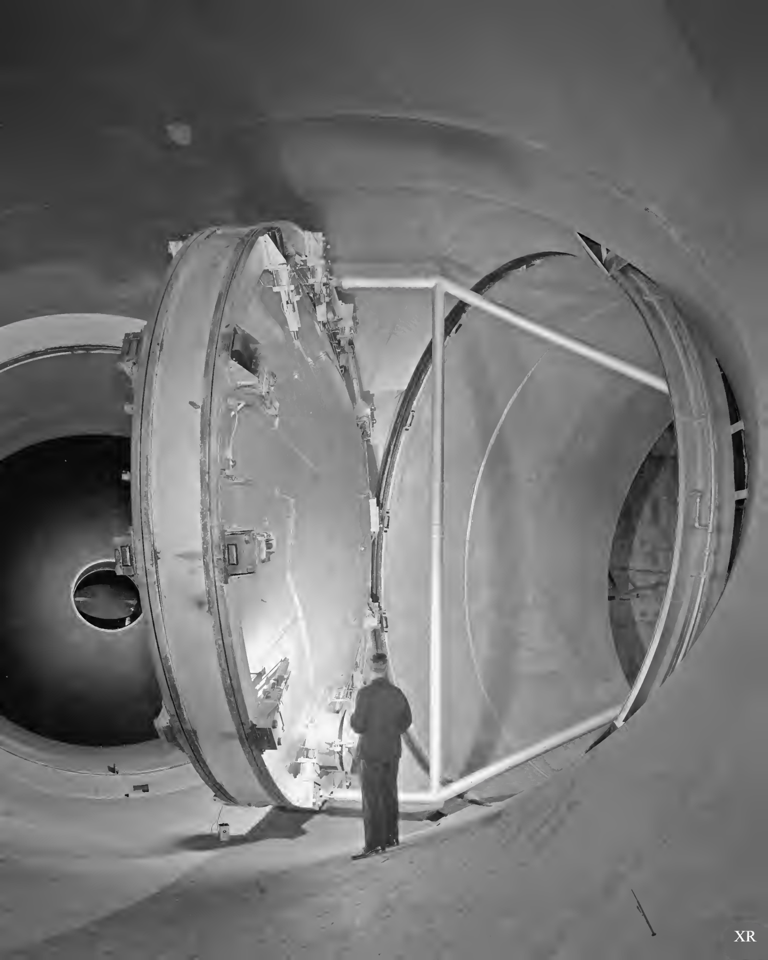

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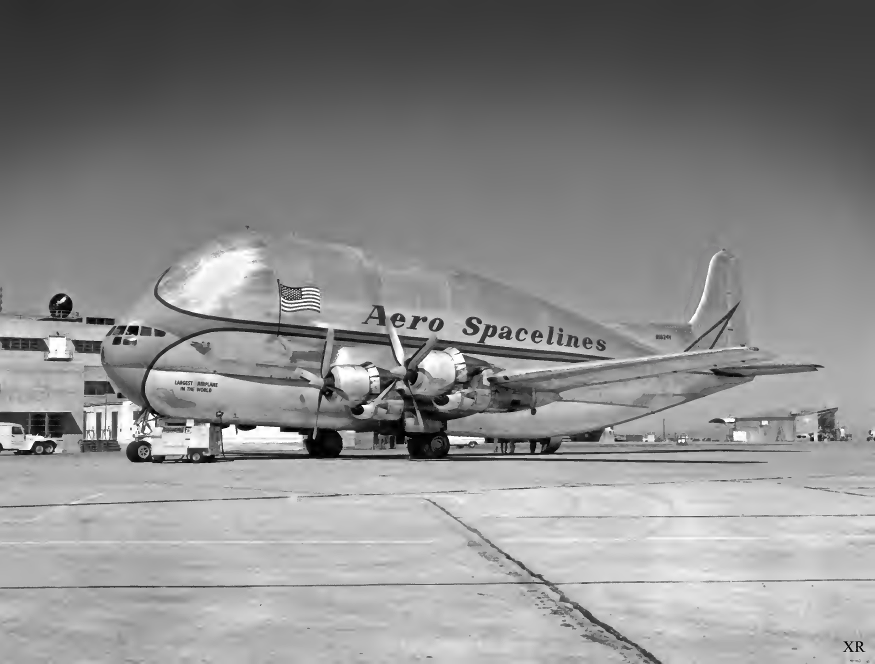
Aero Spacelines
LARGEST AIRPLANE IN THE WORLD
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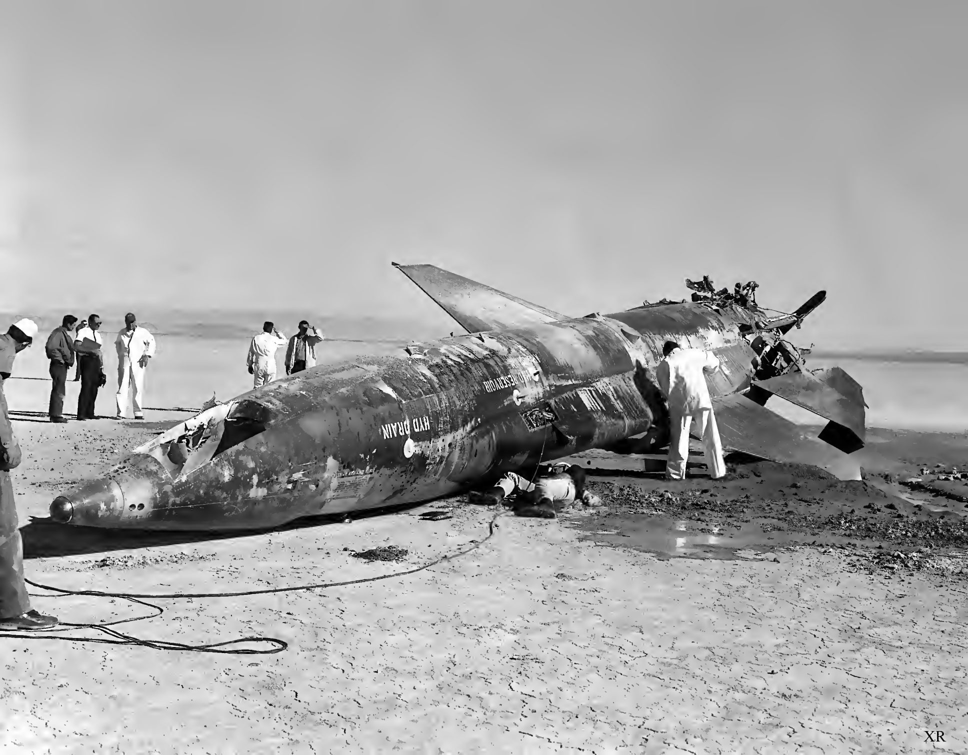
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HYD RESERVOIR
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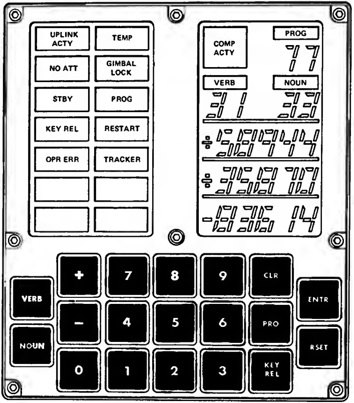
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America's civilian space agency proves

IT'S GOOD BUSINESS TO EXPLORE SPACE

Weather forecasts hatched in space will save billions of dollars a year. Satellite transmitters will beam our television programs around the world. In these and other ways, space will pay back the money spent on exploration. Making facts out of these forecasts is part of the job of the National Aeronautics and Space Administration, the engineer-scientist agency that manages U. S. non-military aerospace programs. NASA adds a condition to predictions of a world space-trade boom: space, itself, must remain free. This freedom, NASA men know, depends on whether America leads or lags as a space explorer.

CHANCE VOUGHT
DALLAS, TEXAS

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What's on the Moon?

The year is nineteen hundred . . . and what? An Apollo space craft is in orbit 100 miles above the moon. In it are three men. Two of them will get into a smaller ship, shaped like a bug. In this "bug" they will try to make a landing on the moon.

What will men on the moon be up against? Will they be able to get back to the Apollo? Will they be able to return to the earth?

No one knows for sure. Scientists don't know about everything that's on the moon. But they do know that

Space Age Adventure Party

for boys 10 to 13 years old

An afternoon of adventuring in outer space is sure to capture the imaginations of the young rocket scientists in your neighborhood.

INVITATIONS

A sample ticket for a trip to outer space opens up to reveal party details.

SOLAR SYSTEM TABLECLOTH

Get a large inexpensive map of the solar system and outer space. Cover the table with a plain-colored cloth, then lay out the map. Cover the map with transparent plastic if you wish to preserve it.

Boys will enjoy looking at the solar system map before you serve the birthday supper.

WHAT TO DO?

Orbiting the Moon: All sit in a circle. One guest who knows the game starts. He says, "I'm going to orbit the moon and I'm going to take . . ." (here he names an article of clothing). To be correct he must name something worn by the person on his left. After he names the article the next person repeats the phrase and he, too, names an article. If he doesn't name something worn by the person on his left, he cannot orbit the moon this round. Go around the circle until every one has caught on to the trick.

Radar Search: Choose an "Explorer" and send him out of the room. While he is gone, hide an object somewhere in the room. When the "Explorer" returns, the group seated in a circle on the floor imitates a radar set. As the "Explorer" moves closer to the object the group makes a loud "Blip, Blip" noise. As he moves away they "Blip" softly. When the "Explorer" finds the object, he chooses a new "Explorer."

SUPPER AFTER SPACE AGE FUN

Sputnik Cheeseburgers
Satellite Tomatoes
Rocket Cake
Saturn Sodas

SPUTNIK CHEESEBURGERS

Prepare open-face cheeseburgers. Garnish with pickle slices held in place with colored toothpicks.

SATELLITE TOMATOES

Cut small carrots, celery sticks, and green onions the same length, about 3½". Wash med. tomatoes; peel, if desired. To make satellites, remove tomato cores. Make two small slashes about ½" long in each tomato on either side of hole where core was removed. Insert a carrot stick and a celery stick. Insert onion in center of each tomato. Serve as individual salads.

SATURN SODAS

Since yellow-orange rings surround Saturn, serve a scoop of orange sherbet in each tall glass of cold orange-flavored soft drink.

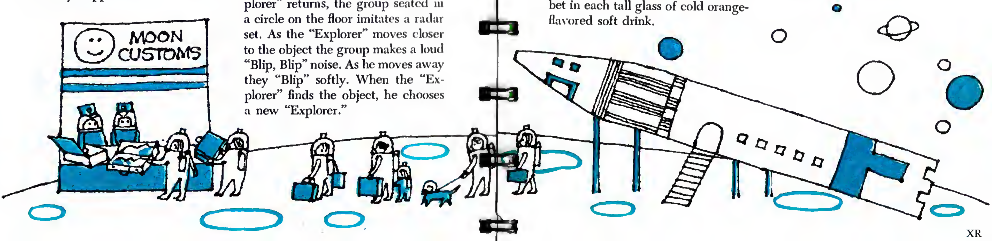
ROCKET CAKE

Bake Angel Cake Roll as directed on Betty Crocker Angel Food Cake Mix pkg. Fill with Cocoa Fluff (below) and roll along long edge into 15" roll. Prepare Betty Crocker Creamy White Frosting Mix, tinting a small amount red in a separate bowl. Frost roll, decorating with a 1 to 2" wide red band around the middle. Finish with a shiny nose cone fashioned of heavy-duty aluminum foil. Add tail fins at back (use sugar wafers or 5" right triangles of white cardboard).

Cocoa Fluff: Mix 1 cup whipping cream, ½ cup *sifted* confectioners' sugar, ¼ cup cocoa, and a dash of salt in chilled bowl. Beat until stiff enough to hold point.

FAVORS

Give books on planets and space travel selected according to the children's reading levels.



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TWENTY-FIVE CENTS
APRIL 21, 1961

MAN IN SPACE

TIME

THE WEEKLY NEWSMAGAZINE

RUSSIA'S
YURI GAGARIN

$7.00 A YEAR

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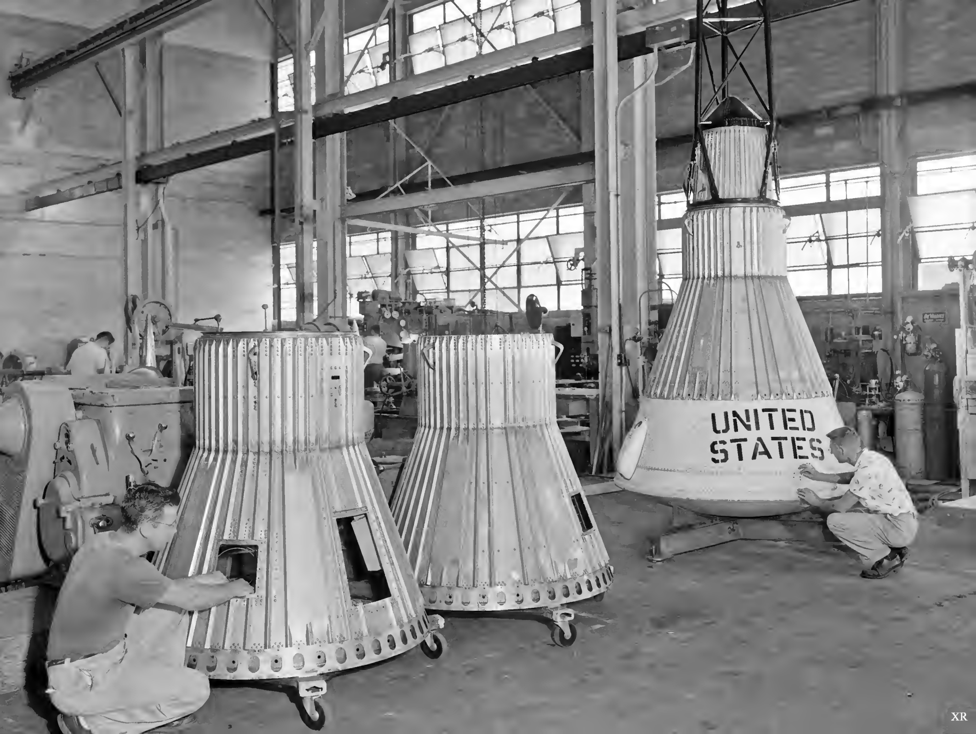
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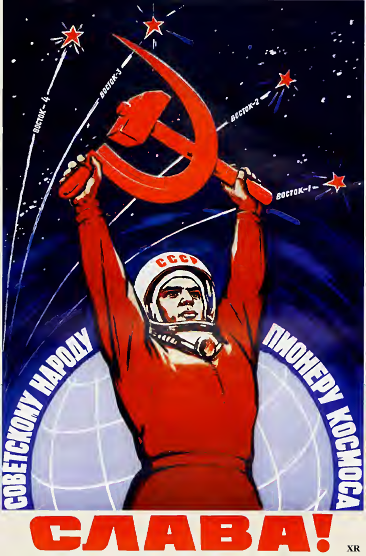
ВОСТОК-4
ВОСТОК-3
ВОСТОК-2
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СССР
СОВЕТСКОМУ НАРОДУ
ПИОНЕРУ КОСМОСА
СЛАВА!

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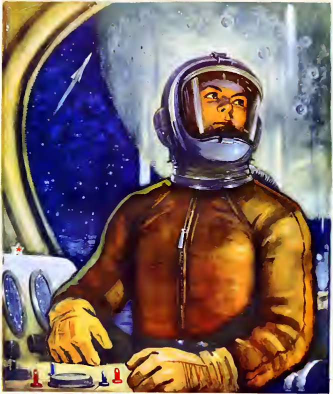

ПОКОРИМ
КОСМОС!

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INTO SPACE WITH ACE BRAVE!

SPACE-MASTER

WITH THREE DIMENSIONAL POP-UP PICTURES

THE MAN FROM OUTER SPACE THINKS OUR PLANES ARE QUITE STRANGE LOOKING MACHINES

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THE FUTURE OF YOUNG AMERICA—CONQUEST OF OUTER SPACE

ASK FOR

JACK BUILT

"Keep Me Busy" Books with COLOR and RE-COLOR FEAT

Lots of things to do • Flip Flop Face •
Super Eyes · Tell Time Clock • A B C •
Bird and Animal • Bozo the Clown •

H LANGE
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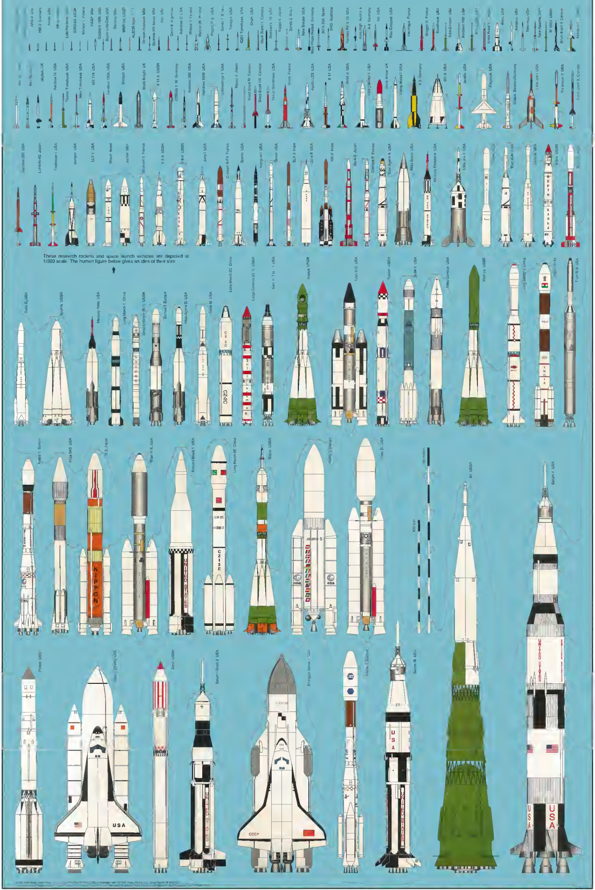
Rockets of the World



These research rockets and space launch vehicles are depicted at 1/300 scale. The human figure below gives an idea of their size

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СССР
ГОРДИСЬ,
СОВЕТСКИЙ
ЧЕЛОВЕК,
ТЫ К ЗВЕЗДАМ ПУТЬ
ОТКРЫЛ С ЗЕМЛИ!

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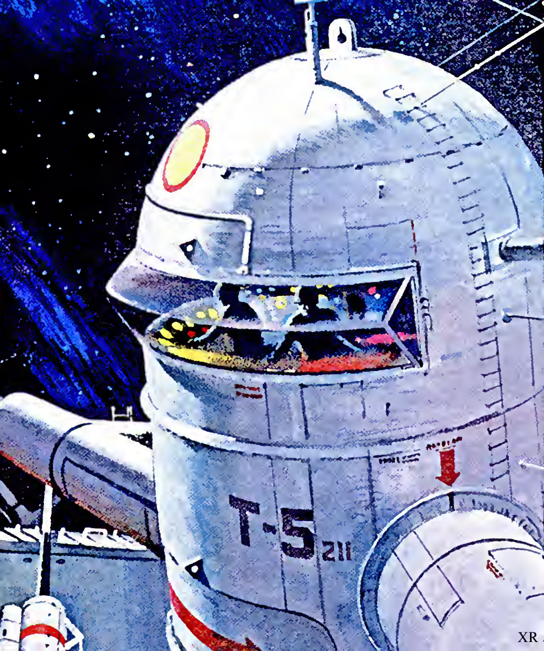
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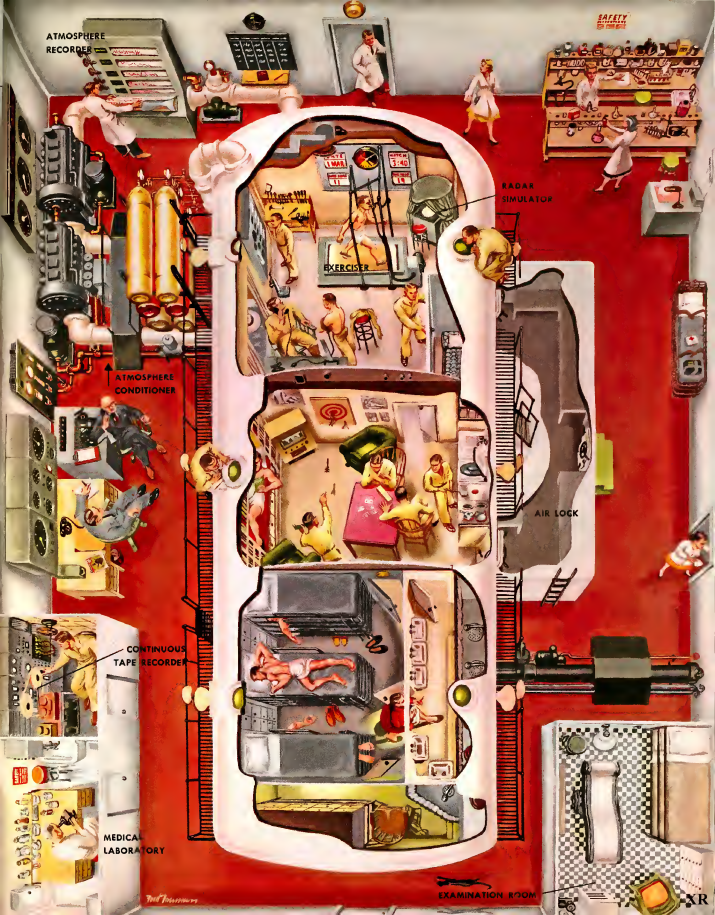
ATMOSPHERE RECORDER
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RADAR SIMULATOR
EXERCISER
ATMOSPHERE CONDITIONER
AIR LOCK
CONTINUOUS TAPE RECORDER
MEDICAL LABORATORY
EXAMINATION ROOM

ment far different from the earth's. It's then that our extreme care in the selection of crew members will pay off.

Obviously, we'll want to test all applicants in pressure chambers. We've been doing that for years with aircraft crews and trainees. But more than that, we'll check our 1,000 for certain physical properties. A person whose circulatory system is under excellent control will be far better equipped to exist for long periods on relatively little oxygen, and in the cramped quarters of a rocket ship, than one with unpredictable variations in blood pressure.

A crew member whose nervous and circulatory systems react swiftly and efficiently to outside temperature changes will be affected only slightly by variations which might incapacitate someone else.

Problems of a Space Vehicle's Crew

Before a space vehicle even leaves the 120-mile-high atmosphere which surrounds the earth, its crew members will have confronted all the problems of low pressure, plus a couple of others: cosmic radiation and ultraviolet radiation.

Ultraviolet radiation doesn't trouble us; it could be dangerous to an unprotected man, but our crew member will never lack the protection of cabin walls, space suit fabric and tinted glass.

Cosmic rays, the minute, ultrahigh-speed, radioactive particles which whiz constantly through the upper atmosphere and space, have been an object of dread for many years—principally because most people know so little about them.

Scientists know enough, however, to be pretty certain of two facts:

First, they aren't as bad as they've been described, not bad enough to constitute a real danger.

Second, their relative harmlessness is a source of vast satisfaction to space scientists, because there's no practical way of protecting space travelers from them. The reasons will be discussed later in this article.

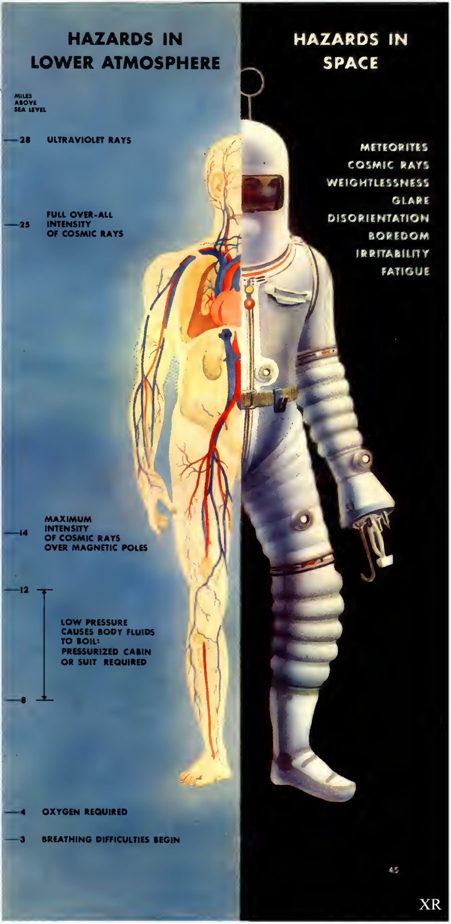
Above the atmosphere, only one more physical hazard confronts the space traveler: meteorites. There again, there is no built-in safeguard in the human body. Medical men are counting on the engineers to provide sufficient protection. But there are other problems we must meet.

In aviation training, the greatest number of men are eliminated because of faulty reactions or poor judgment under actual flight conditions. It isn't easy to provide flight conditions in rocket-ship training; obviously, we can't send potential crew members into space in a multimillion-dollar space vehicle as part of our selection process. Yet it's much more important to weed out the unfit in a

◀ **This device will test candidate's ability to take stresses of space. Roll motor and pitch cylinder will rock and shake chamber; noise will be piped in; pressure and composition of atmosphere will be varied. Prospective crew member will be required to solve problems set into instrument panels by remote control. As he works, electrodes, cardiographs and other instruments attached to his body will record how various organs function under the strain. The heart, brain, eyes, perspiration, blood, muscles all will be checked separately, and technicians and surgeons will see results on analyzer panels. One TV camera will be fixed on candidate, other on the instrument boards**

In lower atmosphere, the hazards at left menace unprotected man. Even crewman in space wearing pressure suit will be subject to dangers noted on right. But none is a serious obstacle to an assault on space today ▶

DRAWINGS BY ROLF KLEP


HAZARDS IN LOWER ATMOSPHERE
MILES ABOVE SEA LEVEL
28 ULTRAVIOLET RAYS
25 FULL OVER-ALL INTENSITY OF COSMIC RAYS
14 MAXIMUM INTENSITY OF COSMIC RAYS OVER MAGNETIC POLES
12
LOW PRESSURE CAUSES BODY FLUIDS TO BOIL: PRESSURIZED CABIN OR SUIT REQUIRED
8
4 OXYGEN REQUIRED
3 BREATHING DIFFICULTIES BEGIN
HAZARDS IN SPACE
METEORITES
COSMIC RAYS
WEIGHTLESSNESS
GLARE
DISORIENTATION
BOREDOM
IRRITABILITY
FATIGUE

A typical space crewman: not too tall, short or stout—and emotionally stable. For some

live inside a protective envelope of his own making, a high-pressure chamber, either within the sealed cabin of his rocket ship or living quarters, or within the sealed casing of his space suit. The new Navy suit—developed under the direction of Captain James Sullivan of the Navy Bureau of Aeronautics—will do the trick.

The Navy space uniform, which is being used experimentally under heavy guard at the National Air Matériel Center, Philadelphia, actually does more than solve the major problems which occur at extreme low pressure. It solves many of the bothersome minor problems, too.

How does a man move around when he's encased in a high-pressure balloon (which is what a space suit is)?

The natural tendency of a pressure-filled suit is to become rigid and unyielding; how can the wearer bend his arms and legs? How can he use his fingers? Turn his head?

The rubber Navy suit permits almost complete mobility by means of a variety of devices, most of them still top secret. Semirigid accordion pleats allow movement of the important body joints: shoulders, elbows, knees. Ingenious wrist joints permit rotation of the hands. Man in space will find that his fingers wriggle almost as freely as they might in a conventional thick glove—and with a sensitivity of touch that's almost completely lacking in normally gloved hands. The helmet is attached at the shoulders, and is so built that a man's head can move comfortably within it. The suit has special slide fasteners which seal the suit as they close.

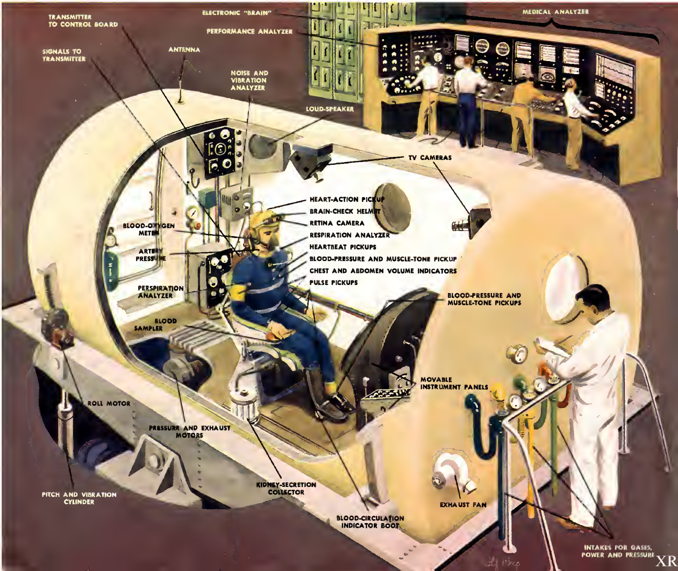
Refinements such as these explain, in part, why the suit cost about $225,000 to develop. (It was made by the B. F. Goodrich Company, using fabricating techniques developed by the David Clark Company and hardware by the Firewel Company and Bendix Aviation Corporation. In production—it will be made in three sizes—its price will drop to about $2,000 per suit.) But the real significance of the uniform is the near-perfect protection that it gives against the big hazards: lack of oxygen, blood-boiling low pressure and temperature variation.

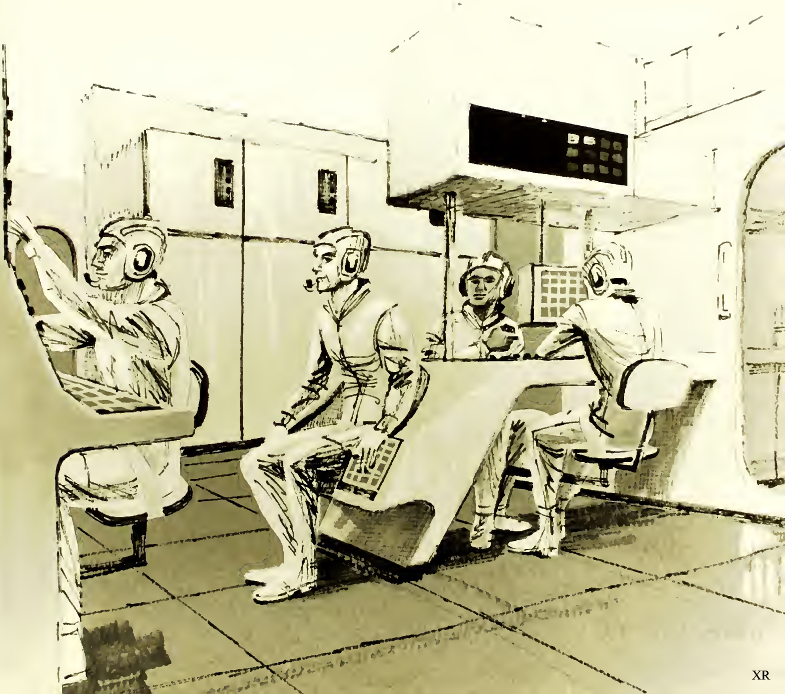
If the crew member gets all that protection, why worry about special aptitudes? Couldn't any individual live comfortably in an artificial atmosphere almost identical to the earth's?

The answer is no. Some people simply can't endure man-made atmosphere. Scientists aren't sure why, although it seems certain that the reasons are largely psychological. Pressure-chamber and pressure-suit tests show that a certain percentage of any group will fold up under conditions which other people don't mind at all. And a few can take low pressures that would knock out almost anyone else.

Those are the few we want.

Suppose a rocket-ship cabin develops a leak. It's possible; no equipment is perfect. The crew members will be so well-versed in emergency procedures that the leak probably will be plugged in a few moments—but for those few moments all personnel aboard the ship will have to cope with an environ-


TRANSMITTER TO CONTROL BOARD
SIGNALS TO TRANSMITTER
ELECTRONIC "BRAIN"
PERFORMANCE ANALYZER
MEDICAL ANALYZER
ANTENNA
NOISE AND VIBRATION ANALYZER
LOUD-SPEAKER
TV CAMERAS
HEART-ACTION PICKUP
BRAIN-CHECK HELMET
RETINA CAMERA
RESPIRATION ANALYZER
HEARTBEAT PICKUPS
BLOOD-PRESSURE AND MUSCLE-TONE PICKUP
CHEST AND ABDOMEN VOLUME INDICATORS
PULSE PICKUPS
BLOOD-OXYGEN METER
ARTERY PRESSURE
PERSPIRATION ANALYZER
BLOOD SAMPLER
BLOOD-PRESSURE AND MUSCLE-TONE PICKUPS
MOVABLE INSTRUMENT PANELS
ROLL MOTOR
PRESSURE AND EXHAUST MOTORS
PITCH AND VIBRATION CYLINDER
KIDNEY-SECRETION COLLECTOR
EXHAUST FAN
BLOOD-CIRCULATION INDICATOR BOOT
INTAKES FOR GASES, POWER AND PRESSURE



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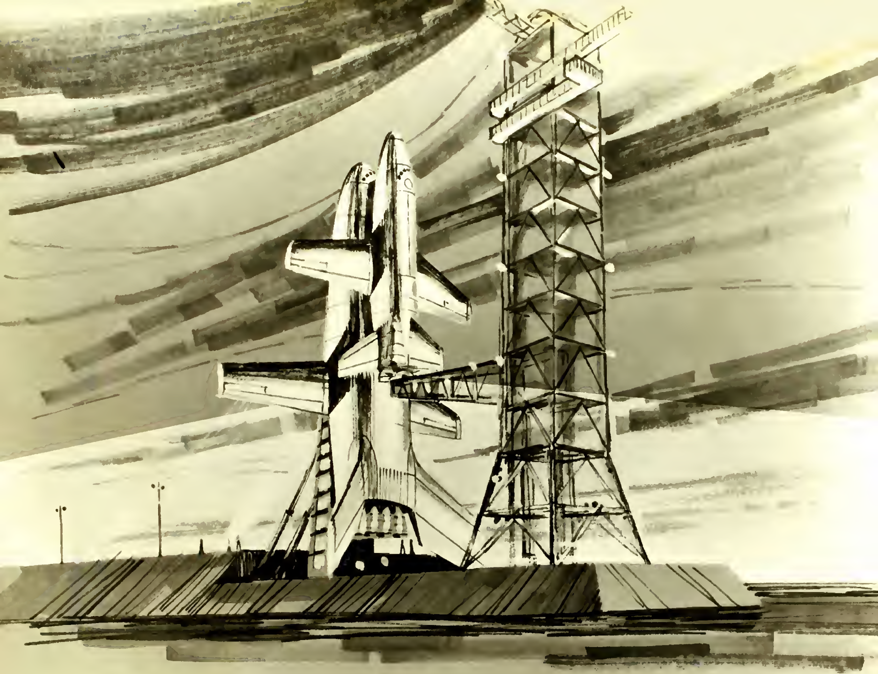

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GFE COMPUTER NAVIGATION AND GUIDANCE CONTROL
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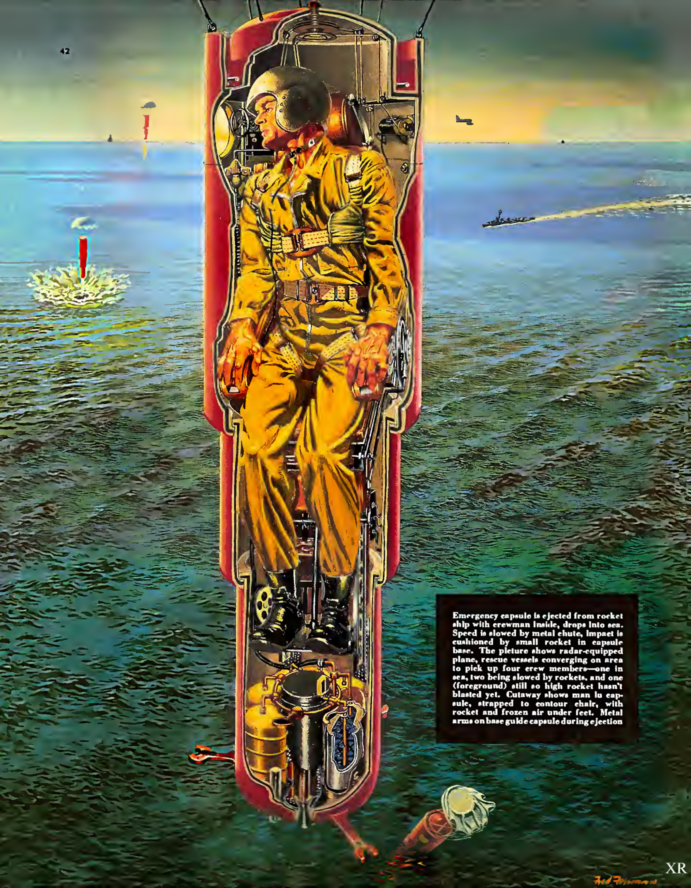

Emergency capsule is ejected from rocket ship with crewman inside, drops into sea. Speed is slowed by metal chute, impact is cushioned by small rocket in capsule base. The picture shows radar-equipped plane, rescue vessels converging on area to pick up four crew members—one in sea, two being slowed by rockets, and one (foreground) still so high rocket hasn't blasted yet. Cutaway shows man in capsule, strapped to contour chair, with rocket and frozen air under feet. Metal arms on base guide capsule during ejection

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will climb aboard their new space-going rocket ship—but not for rocket-propelled flight.

The pioneer space crews and the first space ships will be developed together. All the time the men—and women; they'll probably be on rocket crews, too—are taking their training, engineers will be hard at work perfecting the vehicles. Crews and ships will be ready to undergo testing at about the same time. They'll do that together, too.

The vehicle that takes man into space will consist of three sections, or stages. Two of them will simply be power packages which will hurl the third section spaceward at a great speed and then be discarded. Only the third stage will actually enter space; it will carry the crew and cargo, and it will have wings and other control surfaces, like those of an airplane, necessary to make landings on earth.

A Start in Basic Escape Training

Since the third stage poses the greatest engineering problems, it will be the first section built. Once it's considered ready for flight, it will be towed aloft by a powerful jet bomber and put through a series of tests. The crew will board it at that time, to get used to it, to help the engineers perfect the internal layout, and—especially—to start basic escape training.

After each test is finished, the towrope will be cast loose and the two pilots will make the unpowered landing at the home base.

Finally, the day will come when the third stage and its crew are ready for a rocket launching. The ship will be set on a launching platform, tail down, nose pointing skyward. A few final checks, a moment's pressure on a button beside the captain's chair and the four main rocket motors will roar. The needle-nosed ship will rise slowly into the air, picking up speed rapidly until it hits 4,000 miles an hour.

From the moment the craft leaves the ground, the crew must be prepared for breakdowns, for malfunctions, for the early symptoms of danger. The trip—and each such third-stage flight thereafter—will last only about 20 minutes; there's barely enough fuel for a 300-mile trip, up to an altitude of about 30 miles. Into the few minutes of flying time on each flight, the crew members will cram an intense course in emergency procedures.

What emergencies?

Most of the troubles that can crop up in rocket flight are fairly easily handled. Instrument failure? The ship has double sets of instruments—two sets of flight instruments for the captain and copilot, and two of functional instruments for the engineer. Pump trouble may affect a space-bound rocket ship so that it can't make its destination; it will remain aloft long enough to burn up its heavy fuel load, then, light enough to land, it will return to base.

But four difficulties may spell real danger: mechanical trouble in the power plant or hull; failure of specific pieces of electrical equipment for which there are no duplicates; fire, and the sudden loss of cabin pressure. Fortunately, all such breakdowns should be rare.

Effects of Sudden Decompression

Swift decompression could be caused by the accidental opening of an escape hatch or by the sudden blowout of a porthole. It would subject the crew to an enormous pressure change: from the normal cabin pressure of eight pounds per square inch (equal to a 15,000-foot altitude) to the complete vacuum of outer space.

Can men stand such instant decompression? Tests have proved that carefully picked men can. The change would be uncomfortable but not fatal. But unless the crewmen could find swift protection, they would quickly die from exposure to the low pressure, which provides little or no oxygen for breathing, and which very quickly causes the blood, saliva and other body fluids to boil. Space suits? They'll be invaluable in space, to keep men supplied with pressure and oxygen outside their pressure cabins, but they won't be worn inside a rocket ship; they're too clumsy in such cramped quarters under conditions calling for fast movement. And they take a long time to put on.

The solution is a fast-closing personal pressure cabin for each man. Such a cabin already has been designed by Dr. Wernher von Braun, one of the world's foremost rocket engineers. The moment a crew member becomes aware of the cabin leak, he will press two buttons, one on each arm of his contour chair. One button would do, but two will force the crewman to pin both arms to his sides. That's important, because the instant the buttons are pressed, the chair will straighten slightly, and two metal cylinders will zip out of the floor and ceiling and snap shut around the man, encasing him completely in a sealed tube. The tube, called an emergency capsule, is connected to the ship's central air supply. It also has its own pressure-atmosphere system, if needed.

The capsule protects the crew member from the low outside pressure—but isn't he helpless?

Far from it. All the control switches he has been using to do his assigned job are located on the arms of the chair, and the chair arms are inside the capsule with him. Even before the cylinder clapped shut, the control wires were connected to the ship's electrical system through breakaway plugs at the bottom half of the capsule. Chances are good that, even encased within their capsules, the crew members can save the ship.

At the very least, the captain can start back for the earth; when the space craft descends below 20,000 feet, he and the other crew members can emerge from their metal shells and bring the ship in for a normal landing.

Landing May Be on Space Station

Suppose he has a destination in space. Once scientists have the first space-going ships in operation, they will start building a permanent station 1,075 miles from the earth, as a combined military observation point and astronomical observatory (Collier's, March 22, 1952). The station will circle the globe endlessly, once every two hours—an unpowered satellite, like the moon. If our decompressed rocket ship is on its way to the satellite, it might be wise to continue on course. After its arrival, the crew members in their capsules will be removed from the damaged vehicle by space-suited men from the satellite, and taken to the pressurized station. The rocket ship will be repaired before its return flight.

With proper emergency equipment, decompression can be licked fairly simply.

Fire is something else again. Suppose the turbine driving the fuel pump flies apart and a hot splinter rips through the fuel tanks. A stream of ammonialike hydrazine would engulf the motor and fuel systems in searing flame. What then?

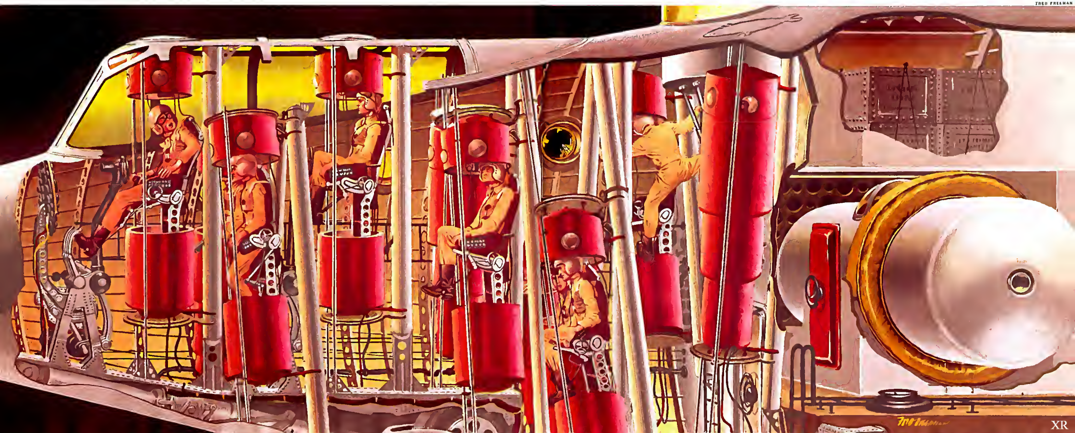
It depends on where the fire is located, how bad it is, how bad it's likely to get—and where the rocket ship is in space. The ship starts its flight from the ground with three sets of rocket motors, mounted one behind another. The first part of each flight is over the ocean. The bottommost, or first, stage provides power until it runs out of fuel, then drops into the sea. The second stage takes over, to be discarded in turn two minutes later. If fire occurs in either of the first two stages, the pilot will immediately jettison it. If he works fast enough, that will end the danger. He will glide the third stage back to earth, after dumping most of its fuel.

But what if the blaze starts just after departure, with the ship only a few thousand feet off the ground? A jettisoned stage, especially if it's aflame, might wipe out the entire launching installation—and hundreds of men. For the rocket captain, it's a tough decision: if he waits too long, he and his crew (and their costly vehicle) might be lost; if

In emergency (as when broken porthole lets cabin pressure escape, as pictured), crewman and passengers press buttons on chair arms; contour seats straighten automatically, capsules clap shut, seal. Capsules are connected to cabin pressure system, also have own pressure for bail-out

To abandon ship, men push another button. Capsules, guided by rails, are ejected by powder charge, drop safely into ocean with men inside. When possible, men will remain in ship, operating controls from within capsules, until they are close enough to the earth to land normally

FRED FREEMAN



Before space-going rocket ship tries out its power, it will undergo tow tests behind jet bomber. Crewmen will board it, try emergency procedures—including bail-out, shown above

Man's Survival in Space

EMERGENCY!

Authorities whose papers were the basis for this article, last of a three-part series, are Dr. Wernher von Braun, chief of the Army Guided Missiles Laboratory; Dr. James P. Henry, of the Air Force Aero Medical Laboratory and rocket expert Willy Ley. Contributors to the other two parts included Col. Don Flickinger, Director of Human Factors at the Air Force Air Research and Development Command; Capt. James E. Sullivan, director, Airborne Equipment Division of the Navy Bureau of Aeronautics; and Drs. Hermann J. Muller of Indiana University; Hubertus Strughold, head of the Air Force Department of Space Medicine; Fritz Haber of the same agency; Donald W. Hastings, National Psychiatric Consultant to the Air Force; James Van Allen of the State University of Iowa; and Heinz Haber of the University of California. The material for the entire series was collected by Collier's Cornelius Ryan

What happens when disaster strikes in space? Can the crew of a 15,000-mile-an-hour rocket ship bail out or land their disabled craft? Here, for the first time, famous scientists disclose the answers

A ROCKET ship is cruising serenely through space at 15,000 miles an hour, its crew relaxing within the pressurized cabin. Suddenly the calm is shattered by an explosion: one of the double-paned portholes has blown out; in an instant the artificial atmosphere has vanished and the five men are exposed to the blood-boiling, suffocating vacuum of space. What can they do?

Or suppose the time is shortly after launching; the ship is picking up speed on a vertical flight path—and suddenly the fuel lines feeding the roaring bank of rocket motors burst into searing flame! Can the crewmen trapped inside bail out—or, perhaps, bring their multimillion-dollar vehicle in for a successful crash landing?

What can men do when disaster threatens their rocket ship during a supersonic dash through the atmosphere, or in the strange, airless environment of space?

If the crew is well trained, there are few emergency situations that can't be licked. The captain may have to make hair-trigger decisions; it may be necessary to throw away machinery and equipment that cost millions of dollars and years of work to develop; it may be necessary to take risks. There'll be plenty of excitement. But for almost all foreseeable crises, there will be an emergency procedure providing a good chance for safety. *If* the crew is well trained.

The first space crews will be more than well trained. They'll be selected with infinite care, superbly conditioned, educated in the special problems of space for five years. Every ground training device our scientists can conceive will give them the feel of space flight—and the problems of space flight—before they ever step into a rocket ship (Collier's, February 28, March 7, 1953).

But the big moment, and the best preparation for danger, will come when they get aboard a space vehicle and go roaring skyward.

There will be some preliminaries. Before they start space flights, the pilot and copilot, both jet-trained, will take many hours of transition flying in single- or double-seat supersonic rocket planes like the present Bell X-2 and Douglas Skyrocket.

Rocket flight is different from any other flight, and the important difference is that it's unpowered, except for a few minutes. (Three rocket blasts lasting a total of five minutes will carry a rocket ship beyond the earth's dense atmosphere; then it will simply coast the rest of the way to its destination.)

Flying in small rocket-powered aircraft, the crew captain and his copilot will learn to expect a sudden power cutoff after a brief burst—and will learn to make every landing glider-fashion, without power, as all rocket pilots must.

Then, with the rest of the crew, the two men

PAINTING BY CHESLEY BONESTELL

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Collier's

MARCH 14, 1953 • FIFTEEN CENTS

Who Will Be
THE NEXT POPE?

•

How Man Will Meet
EMERGENCY
In Space Travel

•

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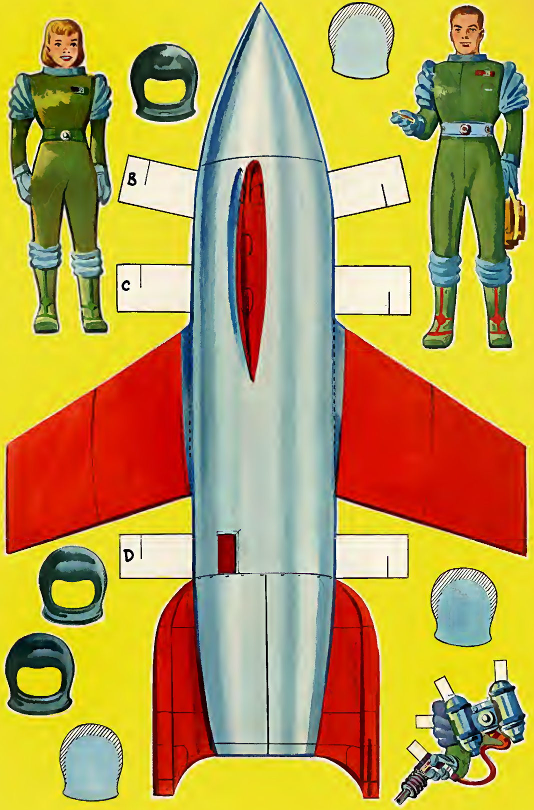

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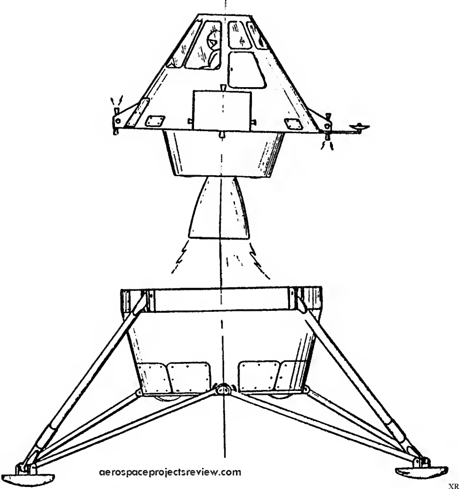

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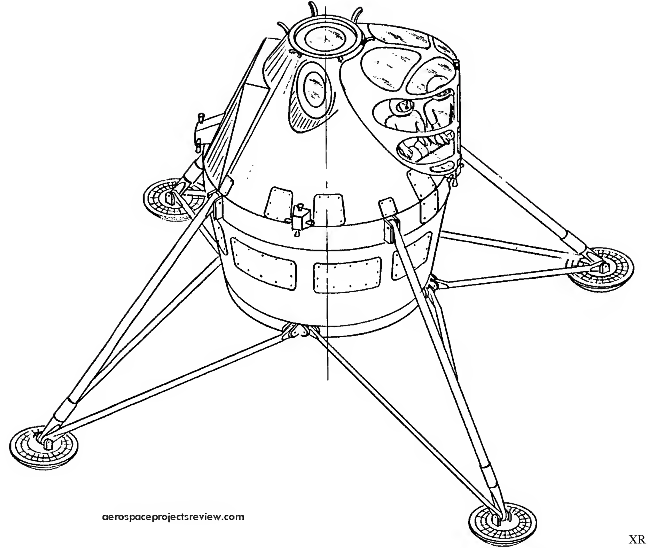

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NASA 7
NASA 6
NASA 2

Man's Survival in Space

Testing the Men

Disaster is the penalty for an error in space. The pioneer rocket crews will practice for perfection on earth, aided by a gallery of wonderful machines

RALPH ROYLE

Navy centrifuge at Johnsville, Pa., one of several in use to simulate acceleration force

Eleven top experts contributed to the symposium, Man's Survival in Space. This part, the second of three, is based on papers done by Dr. Wernher von Braun, chief, Army Guided Missiles Laboratory; Dr. Hubertus Strughold, head, Air Force Dept. of Space Medicine; Dr. Fritz Haber of the same agency; Dr. Donald W. Hastings, national psychiatric consultant to the Air Force; Dr. James P. Henry, Air Force Aero Medical Laboratory; rocket expert Willy Ley. Collier's Cornelius Ryan assembled the material

HOW do you make a space man out of an earth man? The tests a human encounters in space, the tasks he is charged with in rocket flight, are like nothing he knew on solid ground: flattening acceleration pressures; brain-twisting navigational problems; nerve-racking confinement in cramped quarters; the problem of moving from one point to another when you're hovering 1,000 miles above the ground. No man experiences such difficulties on earth. How does he prepare to meet them in space?

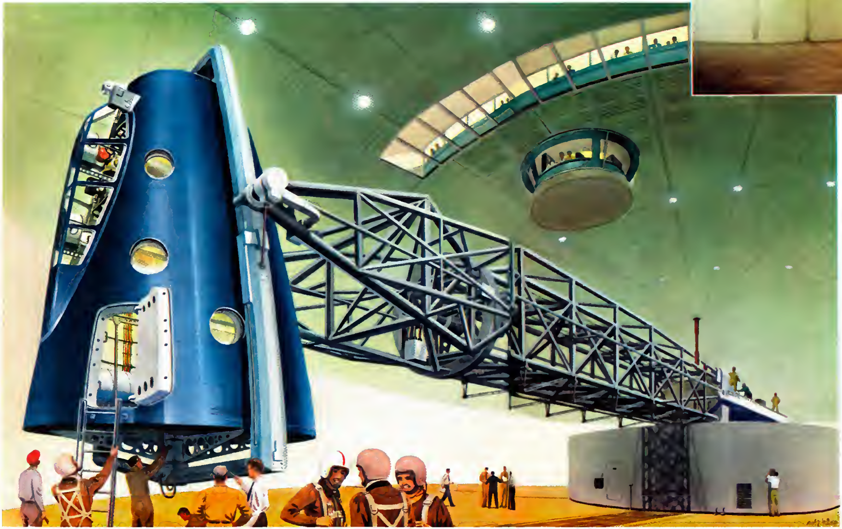
He must prepare on the ground. When he actually gets into space, it will be too late to start learning. Massive, dramatic machines are the teachers—and they already are roughly blueprinted.

One machine (you can see it at the left) will whirl crews around at speeds that reproduce the breath-taking, body-crushing pressures imposed by a fast-rising rocket ship. As the trainer rotates, problems will be fed into the cabin requiring split-second, co-ordinated action from the nearly immobilized crew.

A second machine will teach man to move around in the weightlessness of space. He'll spin, cartwheel, fly violently backward, roll and twist until he gets the hang of self-locomotion.

Trainees also will be jammed together for days in a sealed, boilerlike chamber—working, sleeping, eating, relaxing in a confined space and in a pressurized, synthetic atmosphere.

Navigators dare not be wrong in space; a fractional error may put a speeding vehicle thousands of miles off course. So navigators will have the



Crew centrifuge would expose five persons at once to g pressures, while instructors sent in problems requiring immediate solution. In action, cabin nose would swing down, bringing it into line with centrifuge arm. Operators suspended beneath ceiling could rotate cabin to simulate realistic emergency at launching

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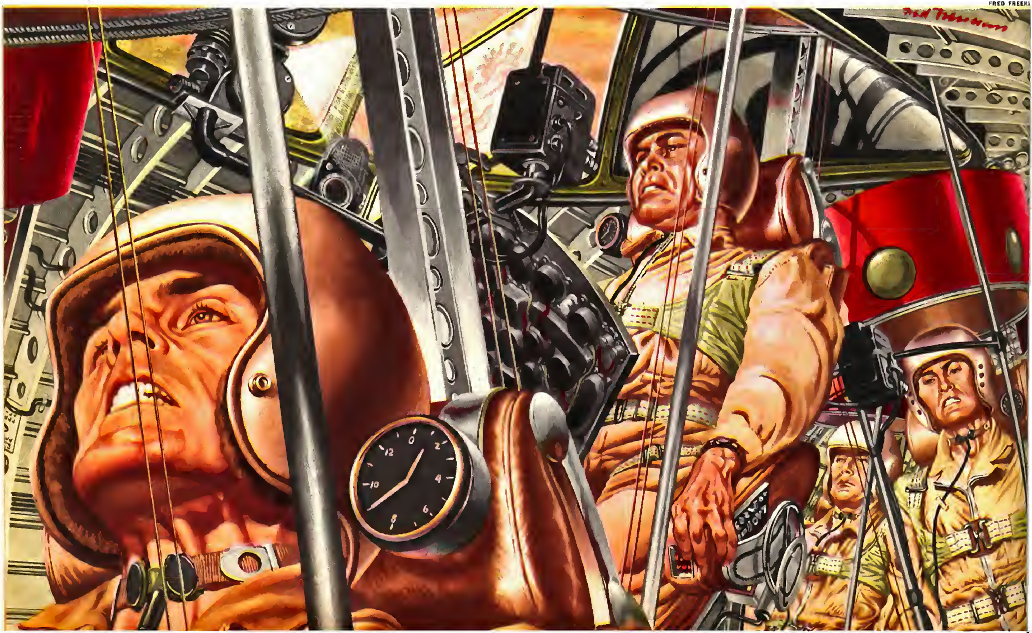
Within cabin of swiftly rotating centrifuge, crew is subjected to terrific strain like that of rocket acceleration. Force sustained equals nine times a man's weight, or nine g's. Problems calling for group action are fed into trainer; crew responds by using fingers to strike armrest buttons

FRED FREEM



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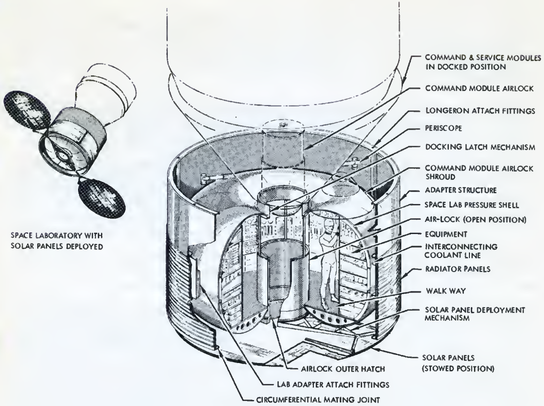

SPACE LABORATORY WITH SOLAR PANELS DEPLOYED

COMMAND & SERVICE MODULES IN DOCKED POSITION
COMMAND MODULE AIRLOCK
LONGERON ATTACH FITTINGS
PERISCOPE
DOCKING LATCH MECHANISM
COMMAND MODULE AIRLOCK SHROUD
ADAPTER STRUCTURE
SPACE LAB PRESSURE SHELL
AIR-LOCK (OPEN POSITION)
EQUIPMENT
INTERCONNECTING COOLANT LINE
RADIATOR PANELS
WALK WAY
SOLAR PANEL DEPLOYMENT MECHANISM
SOLAR PANELS (STOWED POSITION)
AIRLOCK OUTER HATCH
LAB ADAPTER ATTACH FITTINGS
CIRCUMFERENTIAL MATING JOINT

Figure 15. Space Laboratory

The adapter is made of honeycomb panel, reinforced at both ends and in the middle by a total of four frames. Ten space laboratory adapter fittings are attached to the inner wall of the structure. The adapter is split longitudinally in two sections to allow air transport in the C-133 airplane, but the sections are bolted together to form a continuous structure prior to installation on the space laboratory or the service module. The upper end of the adapter contains six tapered longerons with adjustable ends to mate with the service module. The lower end of the adapter terminates in a continuous uniform joint that is part of a circumferential mating ring.

The upper third of the adapter is made of reinforced fiberglass honeycomb; the lower two-thirds is bonded aluminum honeycomb. The fiberglass is used to allow the antenna to radiate outward after the command module and the space laboratory are docked.

The spacecraft adapter will be installed permanently on the space laboratory after the two are mated in final assembly, and 100 square feet of glycol-water loop radiator will be installed on the outside of the adapter for use with the space laboratory environmental control system.

SPACE LABORATORY

Although the space laboratory module, which will be installed in the spacecraft adapter for at least two missions, will be the subject of a separate prime contract, a preliminary design has been accomplished

LUNAR LANDING MODULE

The lunar landing module design has been based upon the landing concept described under Spacecraft Systems. This concept is a sequence of (1) full retrothrust to obtain a vertical descent (nominal end altitude of 40,000 feet and vertical velocity of 350 fps), (2) vertical descent at constant velocity to about 18,000 feet, (3) deceleration with maximum thrust to zero velocity at 100 ft., and (4) controlled thrust vertical touchdown.

A detailed preliminary design of this module was performed to ensure compatibility with the adjacent space vehicle segments. The dominant factor in selecting the configuration, Figure 16, was to provide the lowest possible center of gravity and thus minimize landing gear weight and probability of vehicle overturn. This was achieved by selecting the maximum diameter, 320 inches, compatible with the Saturn S-II stage. The forward end of the lunar landing module is faired to mate with the service module.

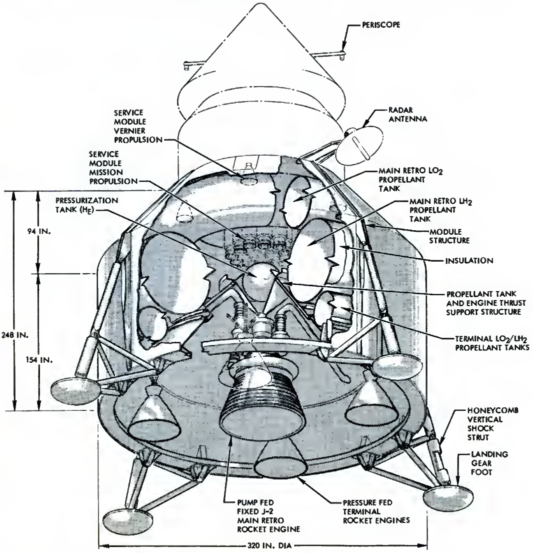
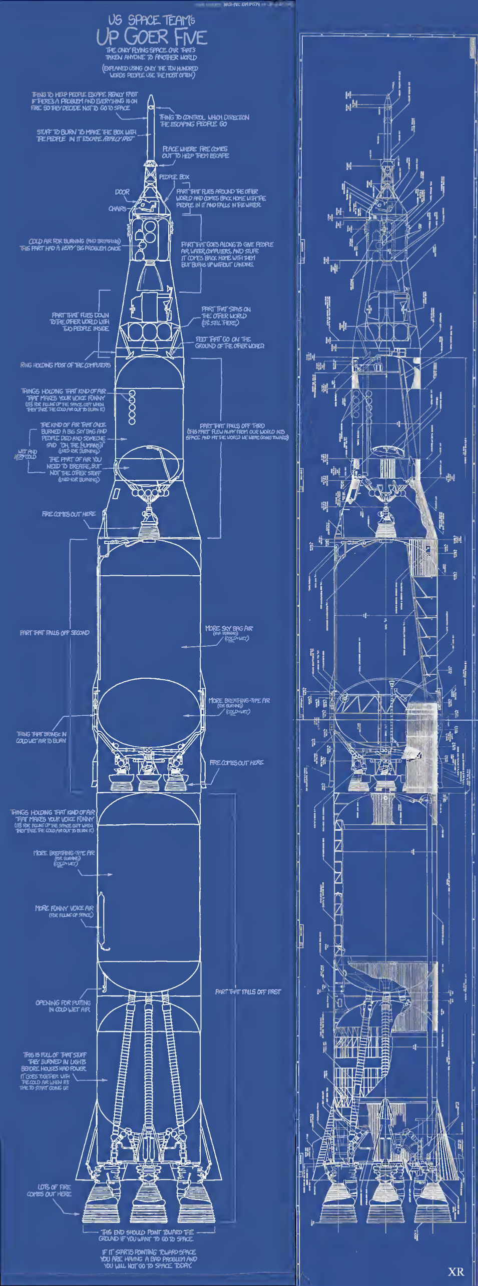

PERISCOPE
RADAR ANTENNA
SERVICE MODULE VERNIER PROPULSION
SERVICE MODULE MISSION PROPULSION
MAIN RETRO LO_2 PROPELLANT TANK
MAIN RETRO LH_2 PROPELLANT TANK
PRESSURIZATION TANK (H_E)
MODULE STRUCTURE
94 IN.
INSULATION
PROPELLANT TANK AND ENGINE THRUST SUPPORT STRUCTURE
248 IN.
TERMINAL LO_2/LH_2 PROPELLANT TANKS
154 IN.
HONEYCOMB VERTICAL SHOCK STRUT
LANDING GEAR FOOT
PUMP FED FIXED J-2 MAIN RETRO ROCKET ENGINE
PRESSURE FED TERMINAL ROCKET ENGINES
320 IN. DIA

Figure 16. Lunar Landing Module


US SPACE TEAM'S
UP GOER FIVE
THE ONLY FLYING SPACE CAR THAT'S TAKEN ANYONE TO ANOTHER WORLD
(EXPLAINED USING ONLY THE TEN HUNDRED WORDS PEOPLE USE THE MOST OFTEN)
THING TO HELP PEOPLE ESCAPE REALLY FAST IF THERE'S A PROBLEM AND EVERYTHING IS ON FIRE SO THEY DECIDE NOT TO GO TO SPACE
THING TO CONTROL WHICH DIRECTION THE ESCAPING PEOPLE GO
STUFF TO BURN TO MAKE THE BOX WITH THE PEOPLE IN IT ESCAPE REALLY FAST
PLACE WHERE FIRE COMES OUT TO HELP THEM ESCAPE
PEOPLE BOX
DOOR
CHAIRS
PART THAT FLIES AROUND THE OTHER WORLD AND COMES BACK HOME WITH THE PEOPLE IN IT AND FALLS IN THE WATER
COLD AIR FOR BURNING (AND BREATHING) THIS PART HAD A VERY BIG PROBLEM ONCE
PART THAT GOES ALONG TO GIVE PEOPLE AIR, WATER, COMPUTERS, AND STUFF. IT COMES BACK HOME WITH THEM BUT BURNS UP WITHOUT LANDING.
PART THAT FLIES DOWN TO THE OTHER WORLD WITH TWO PEOPLE INSIDE
PART THAT STAYS ON THE OTHER WORLD (IT'S STILL THERE)
FEET THAT GO ON THE GROUND OF THE OTHER WORLD
RING HOLDING MOST OF THE COMPUTERS
THINGS HOLDING THAT KIND OF AIR THAT MAKES YOUR VOICE FUNNY (IT'S FOR FILLING UP THE SPACE LEFT WHEN THEY TAKE THE COLD AIR OUT TO BURN IT)
THE KIND OF AIR THAT ONCE BURNED A BIG SKY BAG AND PEOPLE DIED AND SOMEONE SAID "OH, THE [HUMANS]!" (USED FOR BURNING)
WET AND VERY COLD
THE PART OF AIR YOU NEED TO BREATHE, BUT NOT THE OTHER STUFF (USED FOR BURNING)
PART THAT FALLS OFF THIRD (THIS PART FLEW AWAY FROM OUR WORLD INTO SPACE AND HIT THE WORLD WE WERE GOING TOWARD)
FIRE COMES OUT HERE
PART THAT FALLS OFF SECOND
MORE SKY BAG AIR (FOR BURNING) (COLD+WET)
MORE BREATHING-TYPE AIR (FOR BURNING) (COLD+WET)
THING THAT BRINGS IN COLD WET AIR TO BURN
FIRE COMES OUT HERE
THINGS HOLDING THAT KIND OF AIR THAT MAKES YOUR VOICE FUNNY (IT'S FOR FILLING UP THE SPACE LEFT WHEN THEY TAKE THE COLD AIR OUT TO BURN IT)
MORE BREATHING-TYPE AIR (FOR BURNING) (COLD+WET)
MORE FUNNY VOICE AIR (FOR FILLING UP SPACE)
OPENING FOR PUTTING IN COLD WET AIR
PART THAT FALLS OFF FIRST
THIS IS FULL OF THAT STUFF THEY BURNED IN LIGHTS BEFORE HOUSES HAD POWER. IT GOES TOGETHER WITH THE COLD AIR WHEN IT'S TIME TO START GOING UP.
LOTS OF FIRE COMES OUT HERE
THIS END SHOULD POINT TOWARD THE GROUND IF YOU WANT TO GO TO SPACE.
IF IT STARTS POINTING TOWARD SPACE YOU ARE HAVING A BAD PROBLEM AND YOU WILL NOT GO TO SPACE TODAY.
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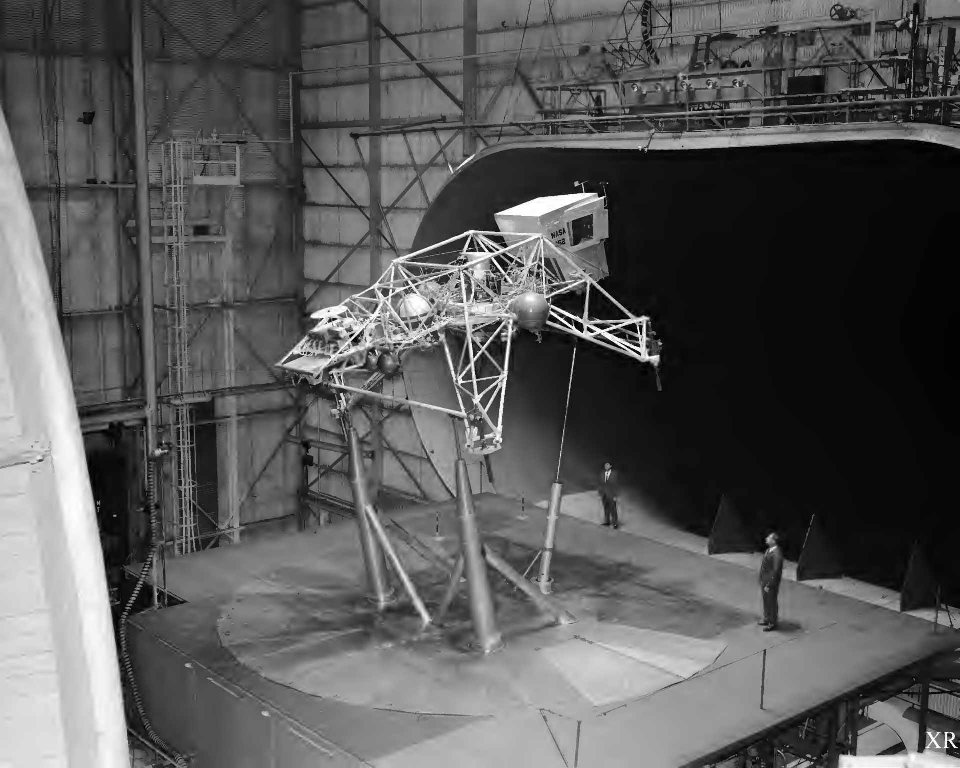

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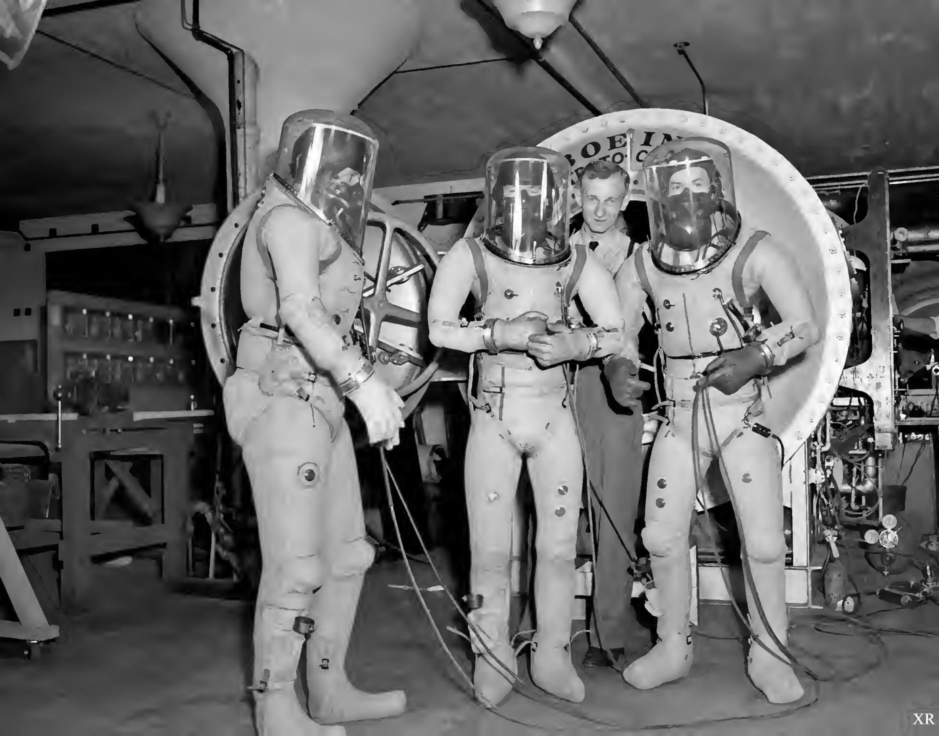

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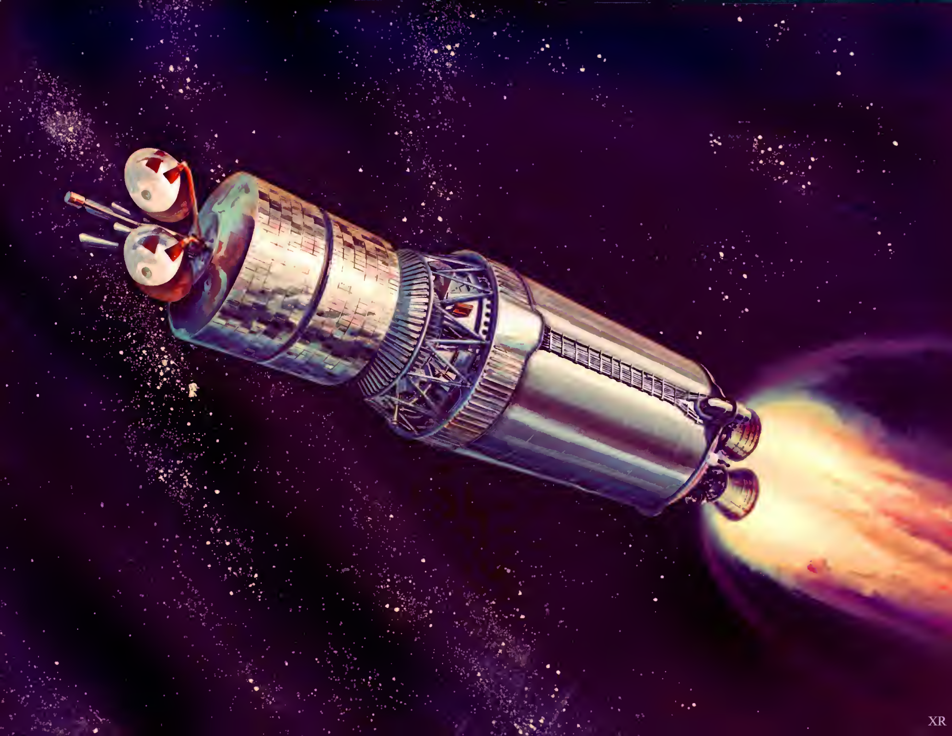

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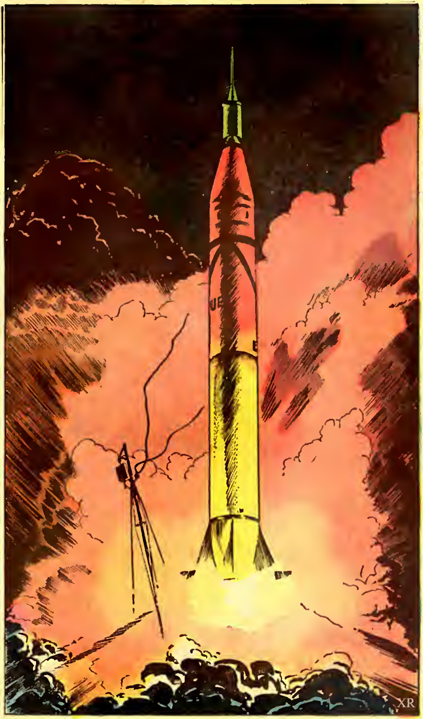
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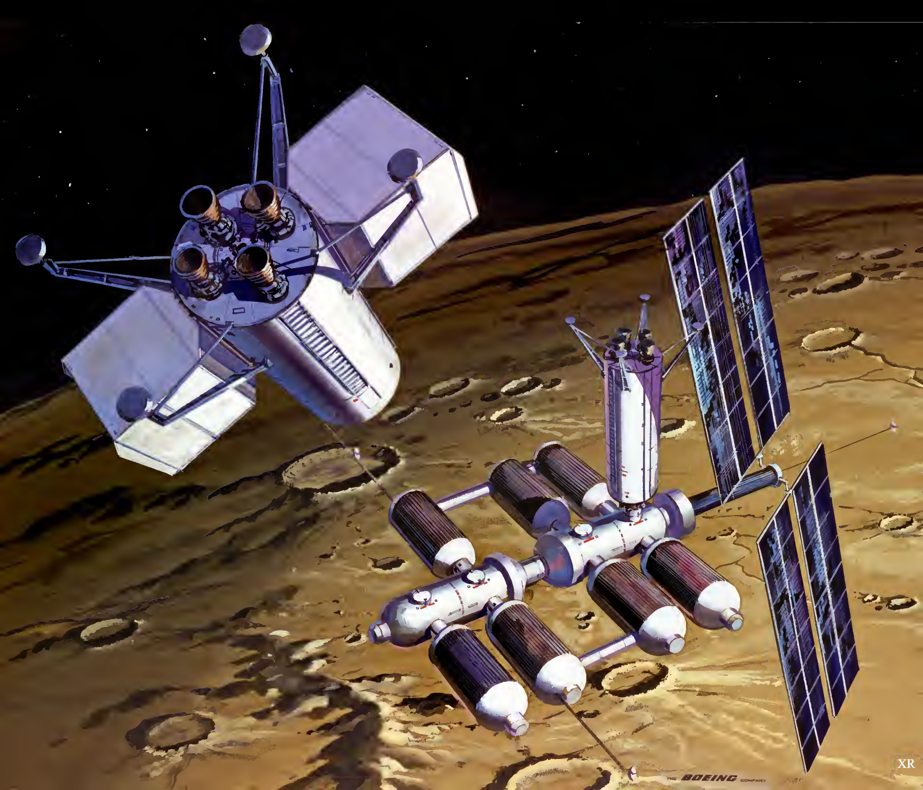
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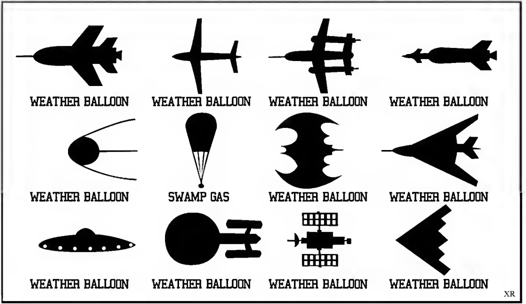
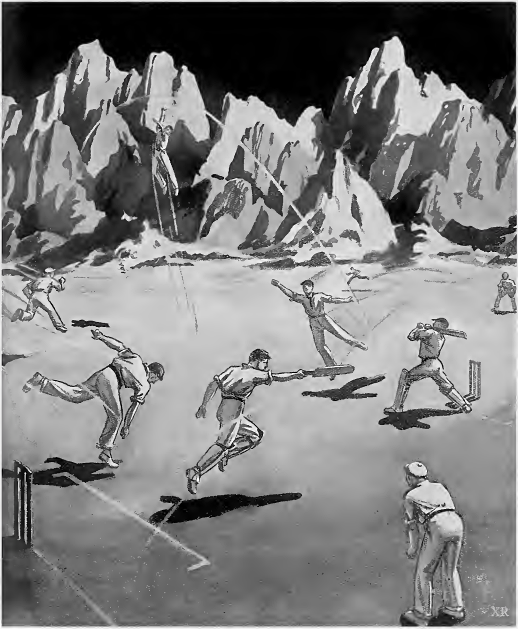
U.S. AIR FORCE AIRCRAFT IDENTIFICATION CHART



IF A TEST MATCH WERE PLAYED ON THE MOON



This imaginative picture shows us in vivid fashion how very different are the conditions on the Moon from what they are on the Earth. Of course, the absence of atmosphere and the tremendous variations of heat and cold would make it impossible for a human being to live on the Moon. But assuming these conditions could be overcome, we should find life on our satellite very strange indeed. The pull of gravitation being so much less, everyone could jump six times as high and run six times as fast and hit six times as hard as on the Earth, while the absence of air would mean that a ball when bowled or struck by a bat would go on without resistance for an enormous distance. A good blow would send the cricket ball hurtling over the mountains, and in most matches, if not all, every ball would be a lost ball. It would be practically impossible to catch balls travelling with such speed. Even in the daytime the sky would be quite dark, for the Sun's rays would reach the Moon direct without being broken up by nitrogen crystals as in our atmosphere

Transparent globe covers futuristic Martian base. At left a monorail can be seen connecting the base with another settlement.

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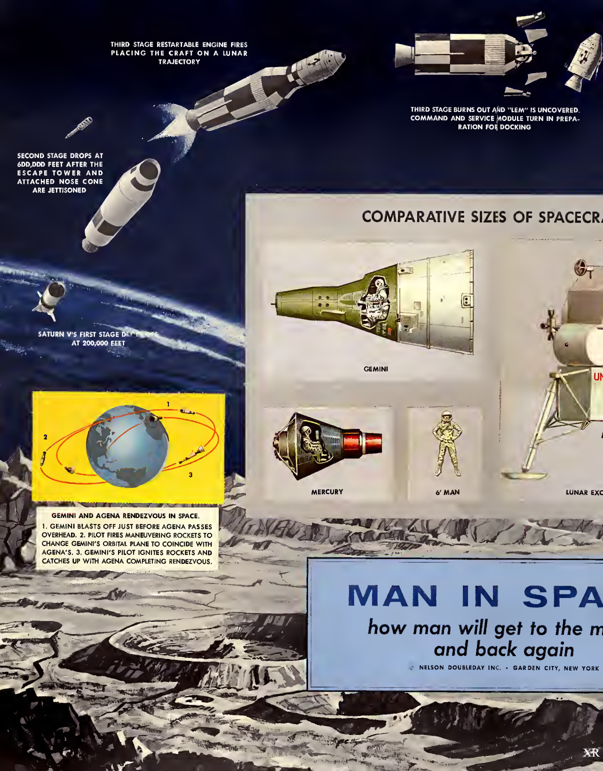

THIRD STAGE RESTARTABLE ENGINE FIRES PLACING THE CRAFT ON A LUNAR TRAJECTORY

THIRD STAGE BURNS OUT AND "LEM" IS UNCOVERED. COMMAND AND SERVICE MODULE TURN IN PREPARATION FOR DOCKING

SECOND STAGE DROPS AT 600,000 FEET AFTER THE ESCAPE TOWER AND ATTACHED NOSE CONE ARE JETTISONED

SATURN V'S FIRST STAGE DROPS OFF AT 200,000 FEET

COMPARATIVE SIZES OF SPACECR

GEMINI AND AGENA RENDEZVOUS IN SPACE.
1. GEMINI BLASTS OFF JUST BEFORE AGENA PASSES OVERHEAD. 2. PILOT FIRES MANEUVERING ROCKETS TO CHANGE GEMINI'S ORBITAL PLANE TO COINCIDE WITH AGENA'S. 3. GEMINI'S PILOT IGNITES ROCKETS AND CATCHES UP WITH AGENA COMPLETING RENDEZVOUS.

MAN IN SPA

how man will get to the m
and back again

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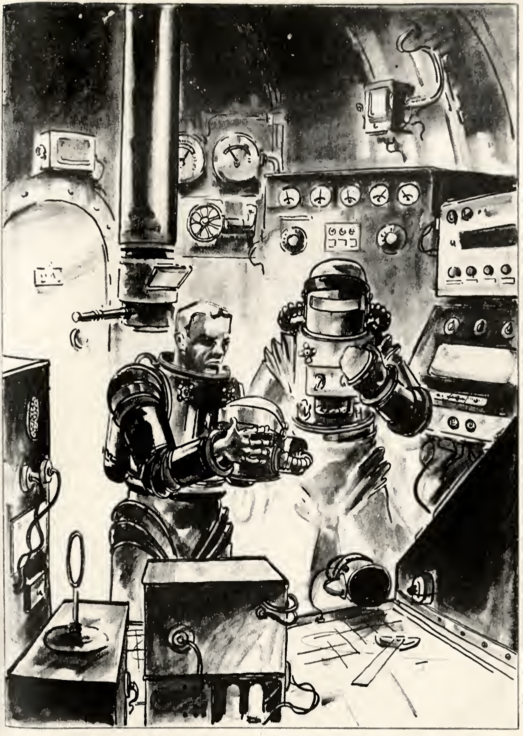

Le vêtement de l'espace a dû être soigneusement mis en place avant l'atterrissage. Les admissions d'air ont été éprouvées ainsi que les appareils chauffants et les postes émetteurs-récepteurs.

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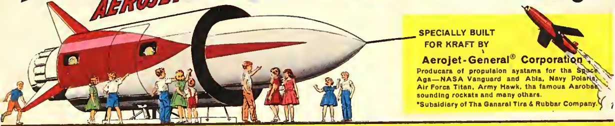

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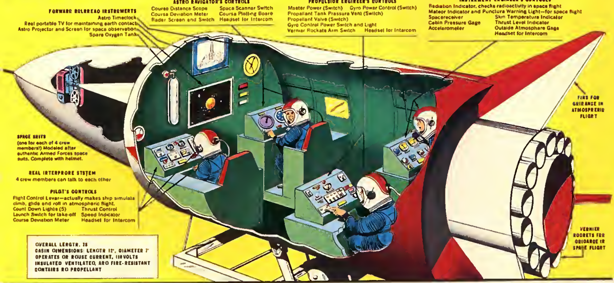

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Course Deviation Meter
Radar Screen and Switch
Space Scanner Switch
Course Plotting Board
Headset for Intercom
PROPULSION ENGINEER'S CONTROLS
Master Power (Switch)
Gyro Power Control (Switch)
Propellant Tank Pressure Vent (Switch)
Propellant Valve (Switch)
Gyro Control Power Switch and Light
Vernier Rockets Arm Switch
Headset for Intercom
INSTRUMENT ENGINEER'S CONTROLS
Radiation Indicator, checks radioactivity in space flight
Meteor Indicator and Puncture Warning Light—for space flight
Spacereceiver
Cabin Pressure Gage
Accelerometer
Skin Temperature Indicator
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Flight Control Lever—actually makes ship simulate climb, glide and roll in atmospheric flight.
Count Down Lights (5)
Launch Switch for take-off
Course Deviation Meter
Thrust Control
Speed Indicator
Headset for Intercom
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OVERALL LENGTH, 28
CABIN DIMENSIONS: LENGTH 12', DIAMETER 7'
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You will be the envy of every boy and girl in America—if you win this Aerojet-General space-trainer giant! So realistic, it almost seems you could fly it to the moon! Just give it the winning name, it's yours!

HINTS TO HELP YOU WIN

It's easy to think up winning names for the ship. For example, you could call it: "Space King," or "Moon Rocket," or "Buddy"—but you can think of even better ones. Just send in your name suggestion with the entry blank below and an empty bag from Kraft Jet-Puffed Marshmallows.

SPECIAL NOTE TO PARENTS: This Training Space Ship has been engineered by Aerojet-General Corporation for use by children as young as 6 years.

50 SECOND PRIZES

$125.00 JUPITER ASTRONOMICAL TELESCOPES

Powerful professional instruments. Can track earth satellites. 132X lens, fully corrected, achromatic; 60 mm. coated objective lens. Sun filter and three eye pieces 40X, 64X, and 89X. 4X cross hair finder. Vertical and horizontal micro-moving position controls. 5½′ adjustable wooden tripod.

LOOK! 5900 MORE CHANCES TO WIN!

100 Prizes. Tigrett Golden Sonic Moon Cars.
500 Prizes. Alpha 1 Ballistic Missiles and Launchers.
300 Prizes. Lindberg Space Ship Model Kits.
Plus 5,000 Giant Hammoud Space Maps in Full Color.

Clip and mail this entry blank! Hurry!

Kraft Space Ship, Box 7569
Chicago 77, Illinois
My name for the Space Ship is________________
I enclose one ( ) empty Kraft Jet-Puffed Marshmallows bag.

NAME____________________
(Please Print)
ADDRESS____________________
CITY____________ ZONE ___ STATE______

FOLLOW THESE SIMPLE RULES

1. Print your suggested name for the Space Ship, plus your own name and address, on the official entry blank printed on Kraft Jet-Puffed Marshmallows bags, or on the entry blank in this ad, or on a plain sheet of paper. Additional entry blanks are available at your store. Mail to Kraft, Box 7569, Chicago 77, Ill. Enter as often as you wish. Each time you enter, use a separate entry blank and send an empty Kraft Jet-Puffed Marshmallows bag.

2. Entries must be postmarked not later than October 31, 1959 and received not later than November 7, 1959 to be eligible for prizes.

3. Contest open to all residents of the U.S., its territories and possessions and Canada, except employees of Kraft, Aerojet-General Corporation, their advertising agencies and families.

4. Entries will be judged on originality, uniqueness and aptness by independent judges. Entries and contents thereof become the property of Kraft and Kraft reserves the right to use or not use the names submitted in the contest. None returned. Duplicate prizes in case of ties. Decision of the judges will be final.

5. Winners will be notified by mail. Contest void in State of Wisconsin and wherever taxed, prohibited, restricted, or license is required.

6. If winner prefers, he may take $5,000 cash and Kraft will donate the Aerojet-General Training Space Ship to a recognized organization in the winner's community.

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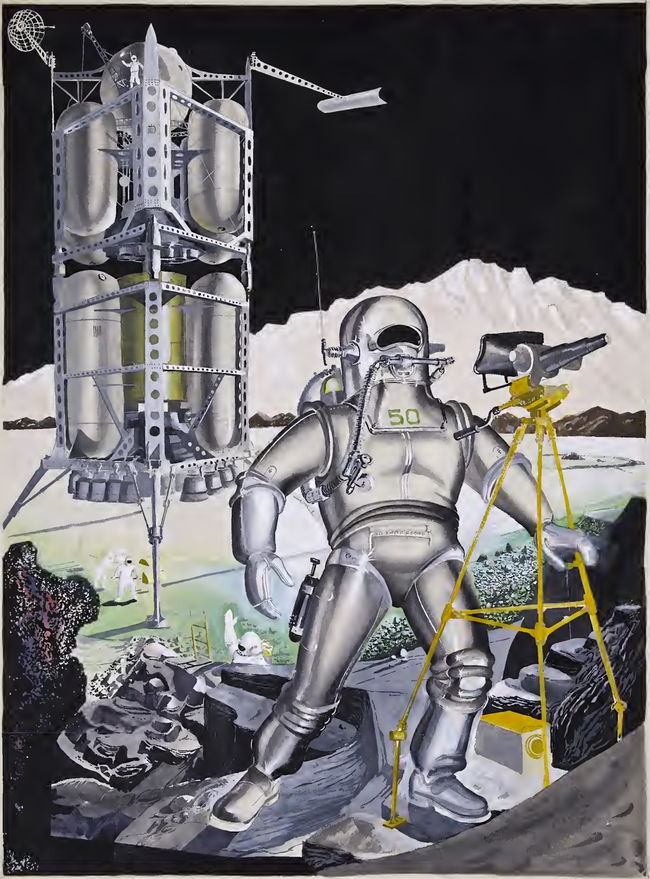

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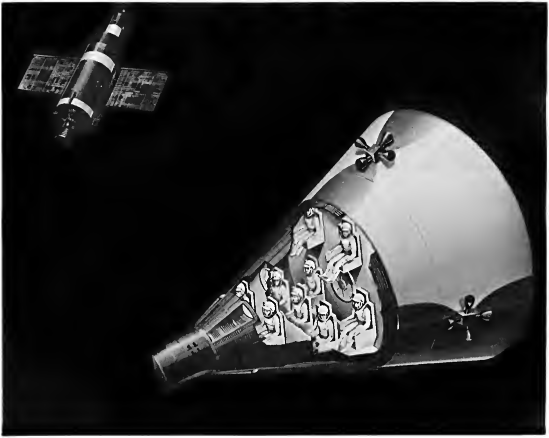
BIG G



Shown above, with its crew section in cutout, is the **Big G** or **Big GEMINI** spacecraft under study by McDonnell Douglas for NASA-Houston (SPACE Daily, Oct. 25, 29 & 31). S-IVB Orbital **WORKSHOP** is seen in the background. Holding a nominal crew of nine plus cargo, the **Big G** would be used as a space shuttle to orbiting space stations in the mid-1970's. It is a top contender in the dual Houston-Marshall space shuttle study (SPACE Daily, Nov. 5, 6 & 21).

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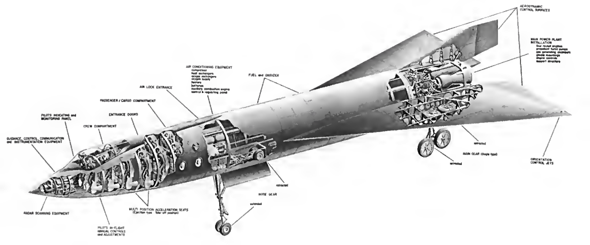
AERODYNAMIC CONTROL SURFACES
MAIN POWER PLANT INSTALLATION
four rocket engines
propellant turbo pumps
gas generating chambers
gimble mountings
engine controls
support structure
AIR CONDITIONING EQUIPMENT
compressor
heat exchangers
oxygen exchangers
oxygen supply
heaters
batteries
auxiliary combustion engine
control & regulating panel
FUEL and OXIDIZER
AIR LOCK ENTRANCE
PASSENGER / CARGO COMPARTMENT
ENTRANCE DOORS
PILOTS INDICATING and MONITORING PANEL
CREW COMPARTMENT
GUIDANCE, CONTROL, COMMUNICATION and INSTRUMENTATION EQUIPMENT
RADAR SCANNING EQUIPMENT
PILOTS IN-FLIGHT MANUAL CONTROLS and ADJUSTMENTS
MULTI POSITION ACCELERATION SEATS (Ejection type Take-off position)
retracted
NOSE GEAR
extended
retracted
MAIN GEAR (Single type)
extended
ORIENTATION CONTROL JETS

FINAL STAGE — FERRY ROCKET VEHICLE
BASIC SATELLITE STRUCTURAL UNIT

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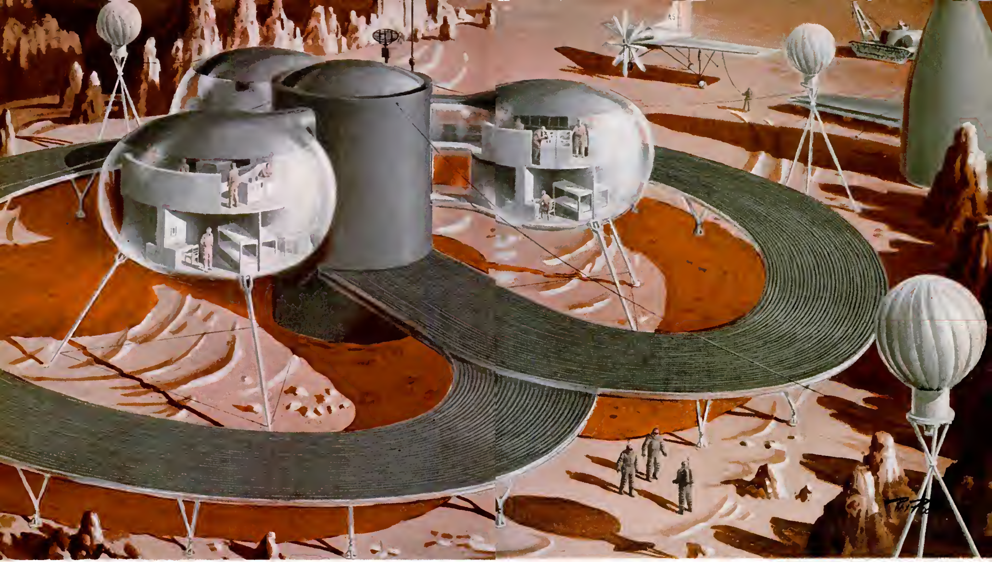

Proposed Mars base looks like this. The heart-shaped ring captures solar heat to warm living quarters for 33 men in spheres and cylinder. Plane and tractor will run in oxygenless air.

How We'll Live on Mars

A bold scientific report describes an amazing scheme that would let a party of 33 set up housekeeping on our neighbor planet.

By Alden P. Armagnac

WHEN the first expedition from Earth sets foot upon the planet Mars, 33 courageous men will make up the landing party.

From a winged rocket ship that has swooped to a horizontal landing on wheeled gear, they will emerge wearing pressurized suits and oxygen helmets.

As they step to the dusty red ground, one of their number beyond doubt will plant a flag to mark the history-making achievement. But there will be scant time for ceremony.

For the landing party's first and press-

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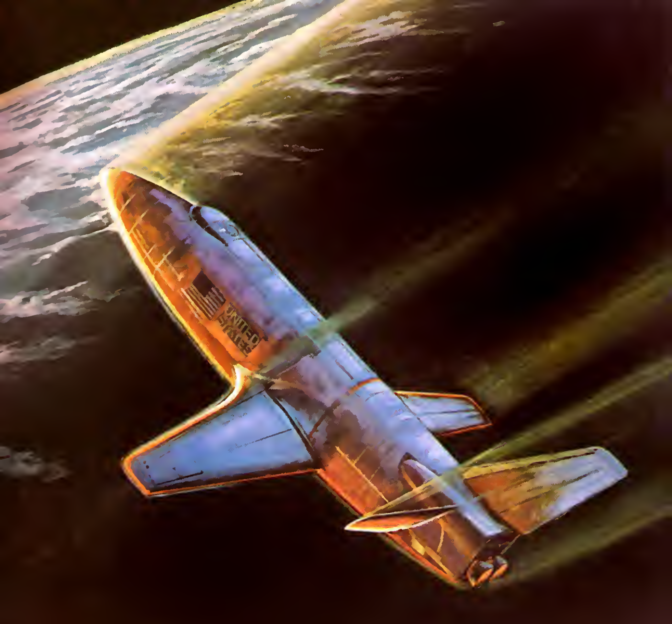

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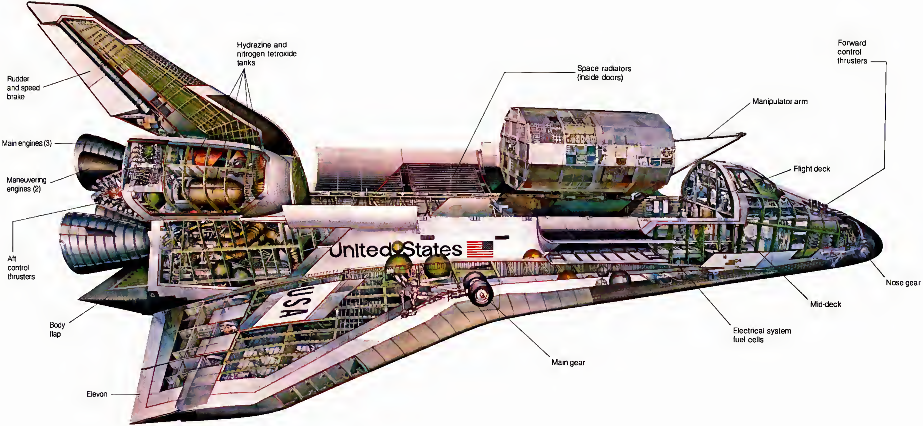

Rudder and speed brake
Hydrazine and nitrogen tetroxide tanks
Space radiators (inside doors)
Forward control thrusters
Manipulator arm
Main engines (3)
Maneuvering engines (2)
Flight deck
United States
USA
Aft control thrusters
Nose gear
Mid-deck
Body flap
Electrical system fuel cells
Main gear
Elevon

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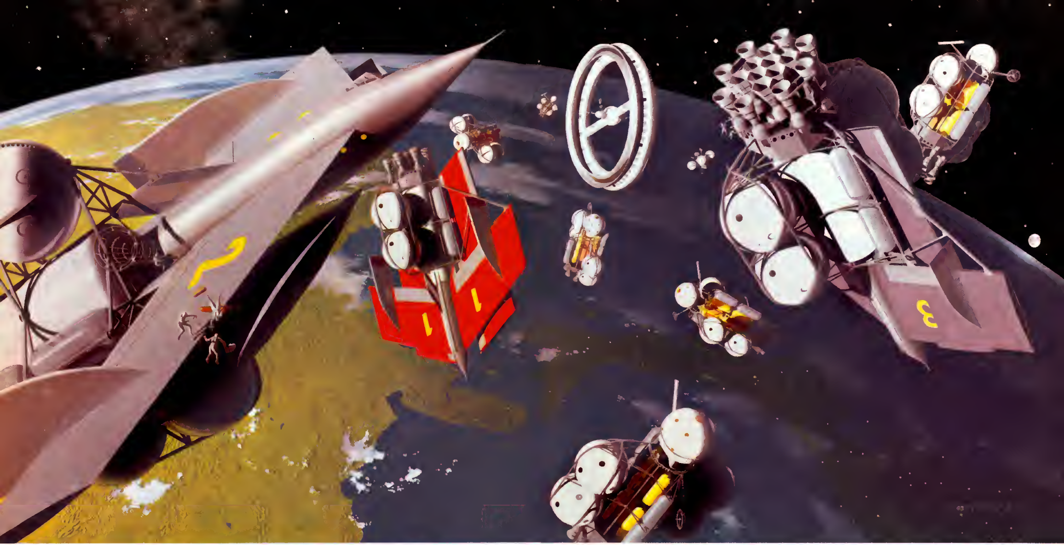

CHESLEY BONESTELL

Near wheel-shaped space station 1,000 miles from the earth, built especially for assembly of the Mars expedition, weightless workers put togeth the 10 rocket ships required for the flight. Three of the huge space craft have torpedo noses which convert to planes for landing on the planet

Can We Get to MARS?

By DR. WERNHER von BRAUN with CORNELIUS RYAN

Chief, Guided Missile Development Division, Redstone Arsenal, Huntsville, Alabama

Man's trail-blazing journey to Mars will be a breath-taking experience—with problems to match

THE first men who set out for Mars had better make sure they leave everything at home in apple-pie order. They won't get back to earth for more than two and a half years.

The difficulties of a trip to Mars are formidable. The outbound journey, following a huge arc 355,000,000 miles long, will take eight months—even with rocket ships that travel many thousands of miles an hour. For more than a year, the explorers will have to live on the great red planet, waiting for it to swing into a favorable position for the return trip. Another eight months will pass before the 70 members of the pioneer expedition set foot on earth again. All during that time, they will be exposed to a multitude of dangers and strains, some of them impossible to foresee on the basis of today's knowledge.

Will man ever go to Mars? I am sure he will—but it will be a century or more before he's ready. In that time scientists and engineers will learn more about the physical and mental rigors of interplanetary flight—and about the unknown dangers of life on another planet. Some of that information may become available within the next 25 years or so, through the erection of a space station above the earth (where telescope viewings will not be blurred by the earth's atmosphere) and through the subsequent exploration of the moon, as described in previous issues of Collier's.

Even now science can detail the technical requirements for a Mars expedition down to the last ton of fuel. Our knowledge of the laws governing the solar system—so accurate that astronomers can predict an eclipse of the sun to within a fraction of a second—enables scientists to determine exactly the speed a space ship must have to reach Mars, the course that will intercept the planet's orbit at exactly the right moment, the methods to be used for the landing, take-off and other maneu-

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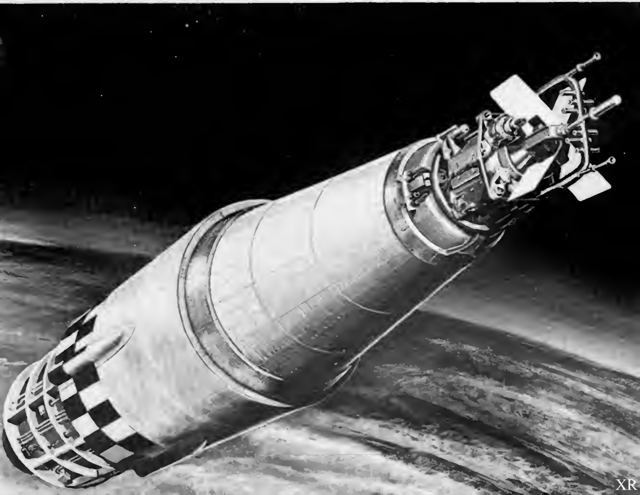
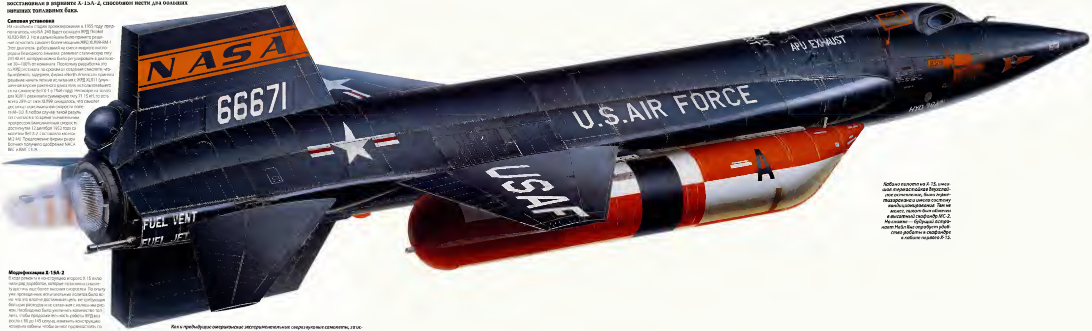
SNAP NUCLEAR SPACE REACTORS



восстановили в варианте X-15A-2, способном нести два больших внешних топливных бака.

Силовая установка

На начальной стадии проектирования в 1955 году предполагалось, что NA 240 будет оснащен ЖРД Thiokol XLR30-RM 2 Но в дальнейшем было принято решение оснастить самолет более мощным ЖРД XLR99-RM-1 Этот двигатель работавший на смеси жидкого кислорода и безводного аммиака развивал статическую тягу 243 48 кН, которую можно было регулировать в диапазоне 30—100% от номинала Поскольку разработка этого ЖРД отставала по срокам от создания самолета чтобы избежать задержек, фирма «North American» приняла решение начать летные испытания с ЖРД XLR11 (улучшенная версия ракетного двигателя, использовавшегося на самолете Bell X-1 в 1946 году) Несмотря на то что два XLR11 развивали суммарную тягу 71 15 кН, то есть всего 28% от тяги XLR99 ожидалось, что самолет достигнет максимальной скорости полета М=3,0 В любом случае такой результат считался в то время значительным прогрессом (максимальная скорость достигнутая 12 декабря 1953 года самолетом Bell X-2 составляла «всего» М 2 44) Предложение фирмы-разработчика получило одобрение NACA ВВС и ВМС США



Модификации X-15A-2

В ходе ремонта в конструкцию второго X 15 включили ряд доработок, которые позволяли самолету достичь еще более высоких скоростей По опыту уже проведенных испытательных полетов было ясно что это вполне достижимая цель не требующая больших расходов и не связанная с излишним риском. Необходимо было увеличить количество топлива, чтобы продолжительность работы ЖРД возросла с 86 до 145 секунд, изменить конструкцию козырька кабины чтобы он мог противостоять по

Как и предыдущие американские экспериментальные сверхзвуковые самолеты, за ис-

Кабина пилота на X-15, имевшая термостойкое двухслойное остекление, была герметизирована и имела систему кондиционирования Тем не менее, пилот был облачен в высотный скафандр МС-2. На снимке — будущий астронавт Нейл Янг опробует удобство работы в скафандре в кабине первого X-15.

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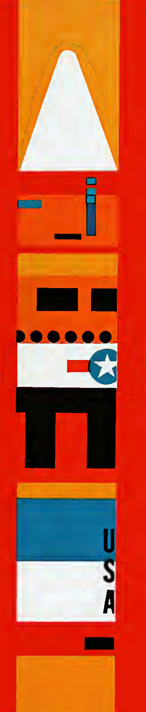
INDUSTRIAL DESIGN

10 *October 1963* *$1.50 per copy*



design for space
packaging section

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GENERAL DECLARATION

(Outward/Inward)

AGRICULTURE, CUSTOMS, IMMIGRATION, AND PUBLIC HEALTH

Owner or Operator NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Marks of Nationality and Registration U.S.A. **Flight No.** APOLLO 11 **Date** JULY 24, 1969

Departure from MOON (Place and Country) **Arrival at** HONOLULU, HAWAII, U.S.A. (Place and Country)

FLIGHT ROUTING

("Place" Column always to list origin, every en-route stop and destination)

PLACE	TOTAL NUMBER OF CREW	NUMBER OF PASSENGERS ON THIS STAGE	CARGO
CAPE KENNEDY	COMMANDER NEIL A. ARMSTRONG	**Departure Place:** Embarking NIL Through on same flight NIL **Arrival Place:** Disembarking NIL Through on same flight NIL	MOON ROCK AND MOON DUST SAMPLES **Cargo Manifests Attached**
	Neil A. Armstrong		
MOON			
JULY 24, 1969 HONOLULU	COLONEL EDWIN E. ALDRIN, JR.		
	Edwin E. Aldrin		
	M. Collins LT. COLONEL MICHAEL COLLINS		

Declaration of Health

Persons on board known to be suffering from illness other than airsickness or the effects of accidents, as well as those cases of illness disembarked during the flight:

NONE

Any other condition on board which may lead to the spread of disease:

TO BE DETERMINED

Details of each disinsecting or sanitary treatment (place, date, time, method) during the flight. If no disinsecting has been carried out during the flight give details of most recent disinsecting:

Signed, if required ______
Crew Member Concerned

For official use only

HONOLULU AIRPORT
Honolulu, Hawaii
ENTERED

Ernest I. Murai
Customs Inspector

I declare that all statements and particulars contained in this General Declaration, and in any supplementary forms required to be presented with this General Declaration are complete, exact and true to the best of my knowledge and that all through passengers will continue/have continued on the flight.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
U.S.A.

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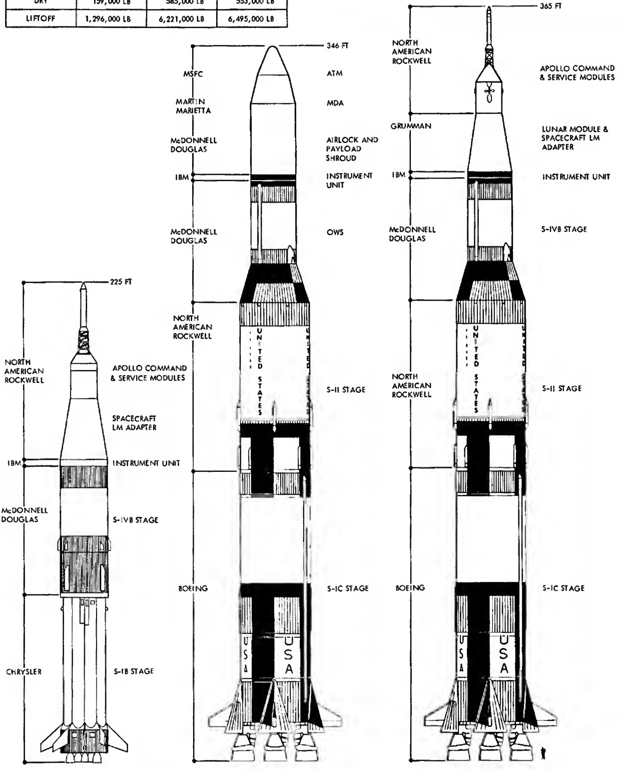
SATURN CONFIGURATIONS

WEIGHT	SATURN IB	SKYLAB SATURN V	APOLLO SATURN V
DRY	159,000 LB	585,000 LB	553,000 LB
LIFTOFF	1,296,000 LB	6,221,000 LB	6,495,000 LB



SATURN IB
2 STAGE

SKYLAB/SATURN V
2 STAGE

APOLLO/SATURN V
3 STAGE

up-ship.com

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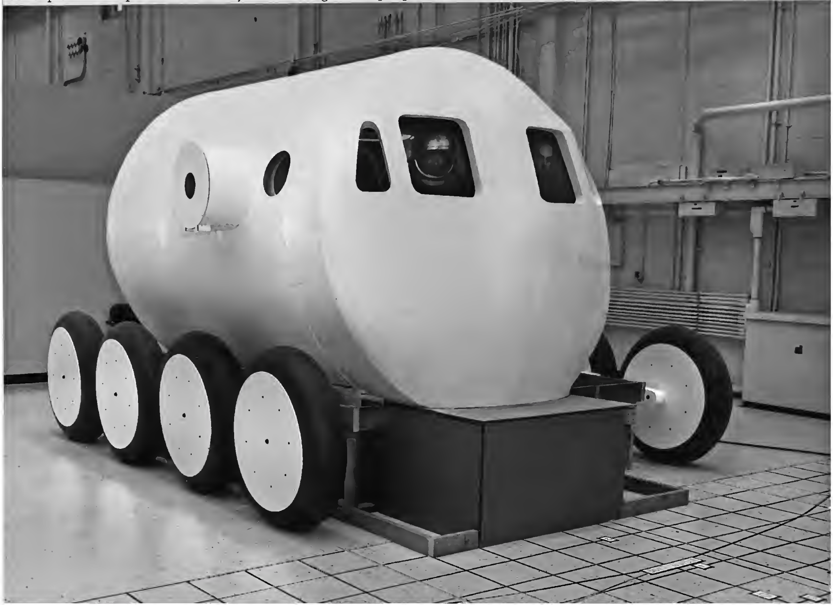
C-H 14547-2

Full-scale mockup of MOLAB class Lunar Roving Vehicle incorporating Northrop's "Walking Beam Suspension" concept. Mockup used for subsystems integration purposes and human factors analysis.



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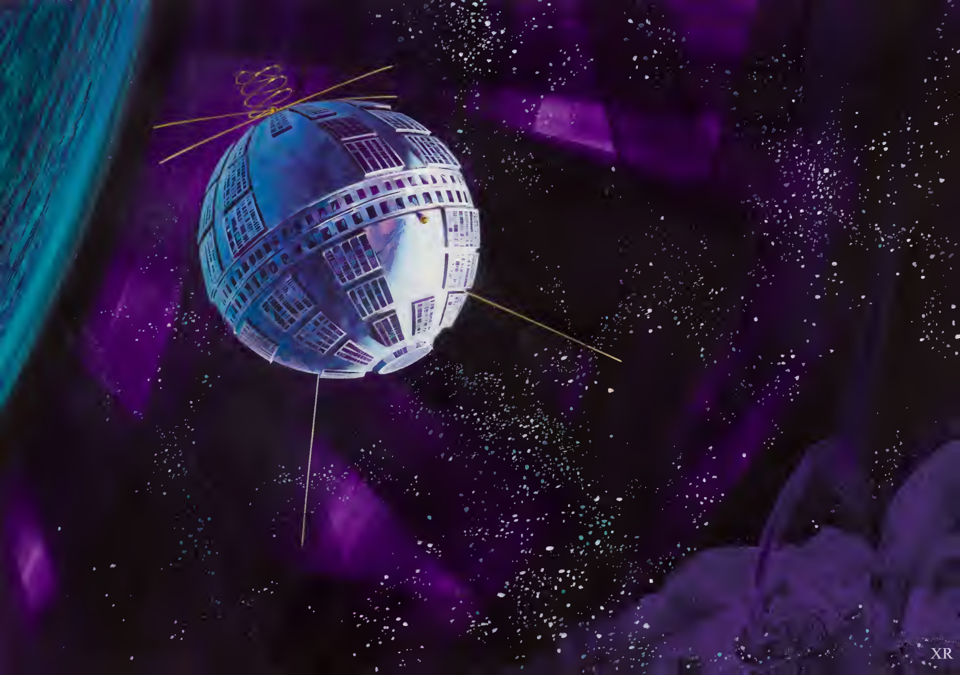
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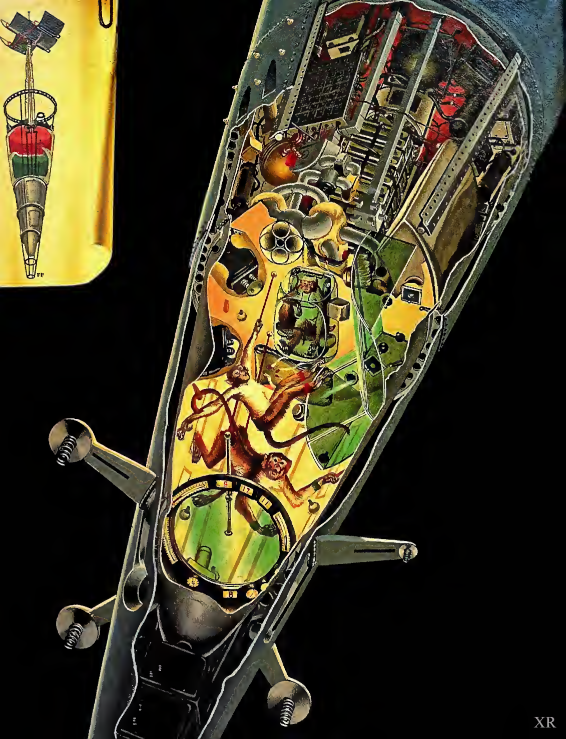

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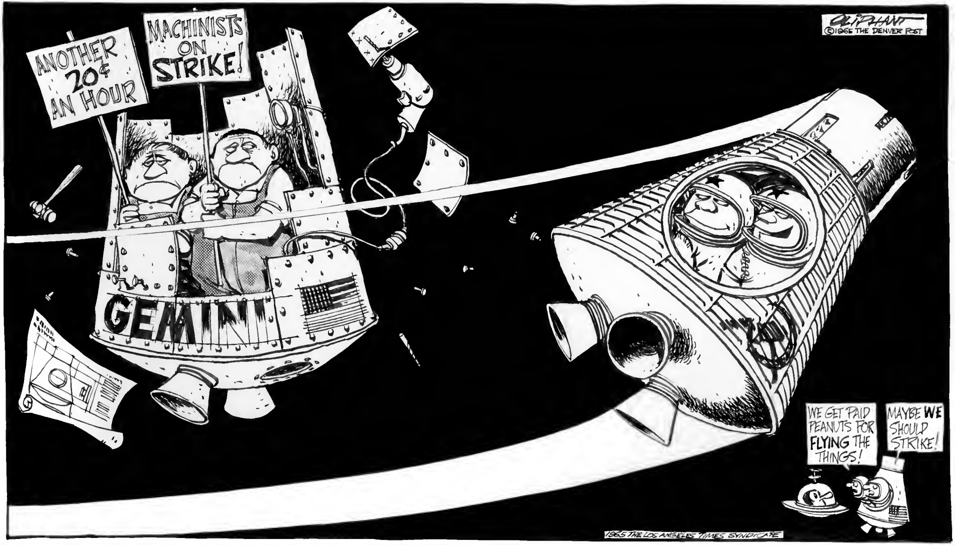
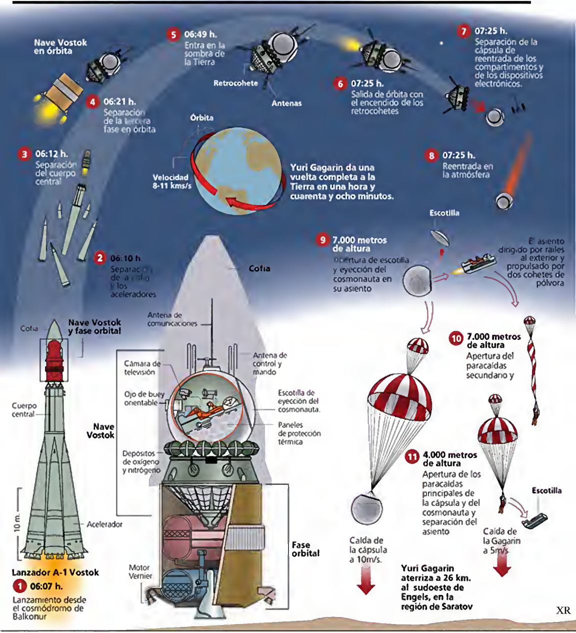


"COMRADE, THERE GOES SOMETHING WE COULD NEVER BUILD IN RUSSIA!"

CARRERA ESPACIAL | URSS

EL PRIMER HOMBRE EN EL ESPACIO

El 12 de abril el cosmonauta ruso Yuri Gagarin protagoniza uno de los acontecimientos más importantes del siglo XX.



Lanzador A-1 Vostok

① **06:07 h.** Lanzamiento desde el cosmódromo de Balkonur

② **06:10 h.** Separación de la cofia y los aceleradores

③ **06:12 h.** Separación del cuerpo central

④ **06:21 h.** Separación de la tercera fase en órbita

⑤ **06:49 h.** Entra en la sombra de la Tierra

Yuri Gagarin da una vuelta completa a la Tierra en una hora y cuarenta y ocho minutos.

⑥ **07:25 h.** Salida de órbita con el encendido de los retrocohetes

⑦ **07:25 h.** Separación de la cápsula de reentrada de los compartimentos y de los dispositivos electrónicos.

⑧ **07:25 h.** Reentrada en la atmósfera

⑨ **7.000 metros de altura** Apertura de escotilla y eyección del cosmonauta en su asiento

El asiento dirigido por railes al exterior y propulsado por dos cohetes de pólvora

⑩ **7.000 metros de altura** Apertura del paracaídas secundario y

⑪ **4.000 metros de altura** Apertura de los paracaídas principales de la cápsula y del cosmonauta y separación del asiento

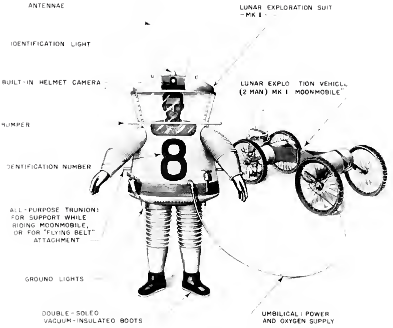
Caída de la cápsula a 10m/s.

Caída de la Gagarin a 5m/s.

Yuri Gagarin aterriza a 26 km. al sudoeste de Engels, en la región de Saratov

Fuente: XXXXX,XXXXXXXX

Documentación: Javier Aguirre | **ADOLFO ARRANZ**


ANTENNAE
LUNAR EXPLORATION SUIT -MK I
IDENTIFICATION LIGHT
BUILT-IN HELMET CAMERA
LUNAR EXPLORATION VEHICLE (2 MAN) MK I "MOONMOBILE"
BUMPER
8
IDENTIFICATION NUMBER
ALL-PURPOSE TRUNION: FOR SUPPORT WHILE RIDING MOONMOBILE, OR FOR "FLYING BELT" ATTACHMENT
GROUND LIGHTS
DOUBLE-SOLED VACUUM-INSULATED BOOTS
UMBILICAL: POWER AND OXYGEN SUPPLY

ESTIMATED WEIGHTS	ON EARTH, LBS	ON MOON, LBS
OCCUPANT	180	30
~~BASIC SUIT ASSEMBLY~~	~~60~~	~~10~~
BATTERY	24	4
TWO WEEKS FOOD SUPPLY	30	5
TWO HOUR O_2 SUPPLY *	24	4
COMMUNICATIONS EQUIPMENT	12	2
READING AND MISCELLANEOUS	12	2
	342	57

* MAJOR PORTION OF O_2 AND WATER SUPPLIED IS CARRIED ON BOARD THE MOONMOBILE

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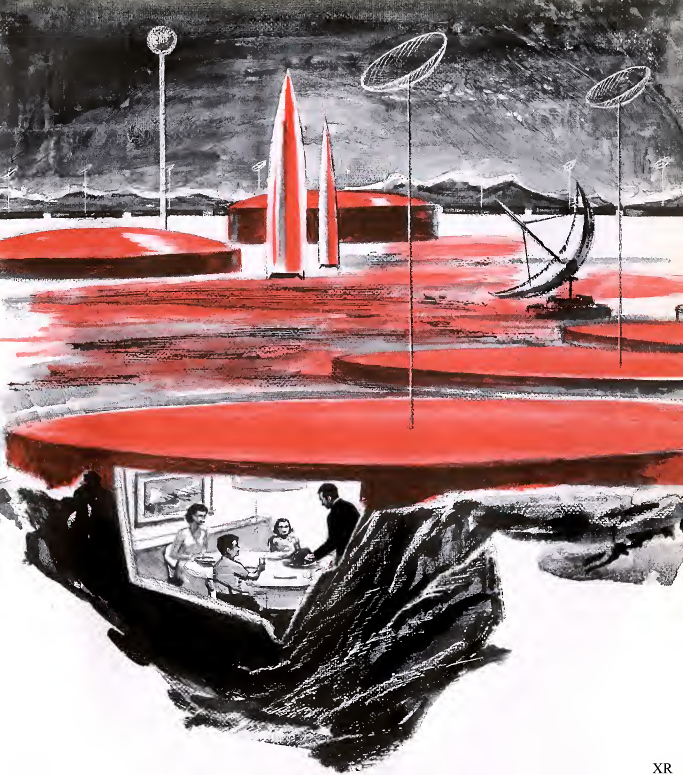

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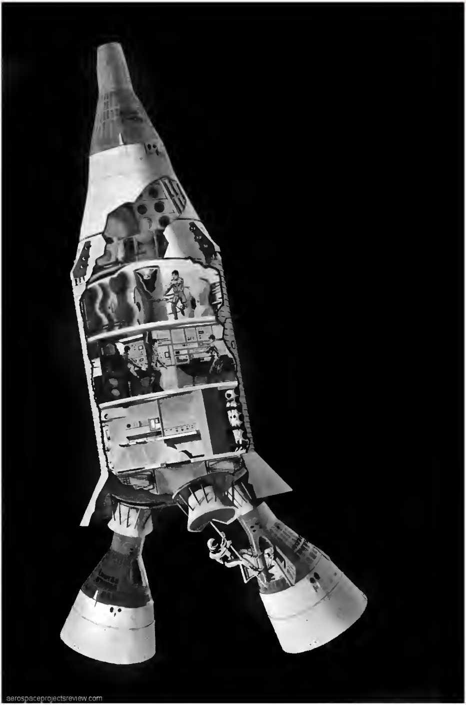

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Figure 8 TYPICAL SIX-MAN SPACE STATION— SATURN IB LAUNCH VEHICLE

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The spacemen will have to wear oxygen suits, for Martian air is very thin. It also may contain poisonous gases. On Mars, the sun will look whiter and much smaller than it does from Earth.

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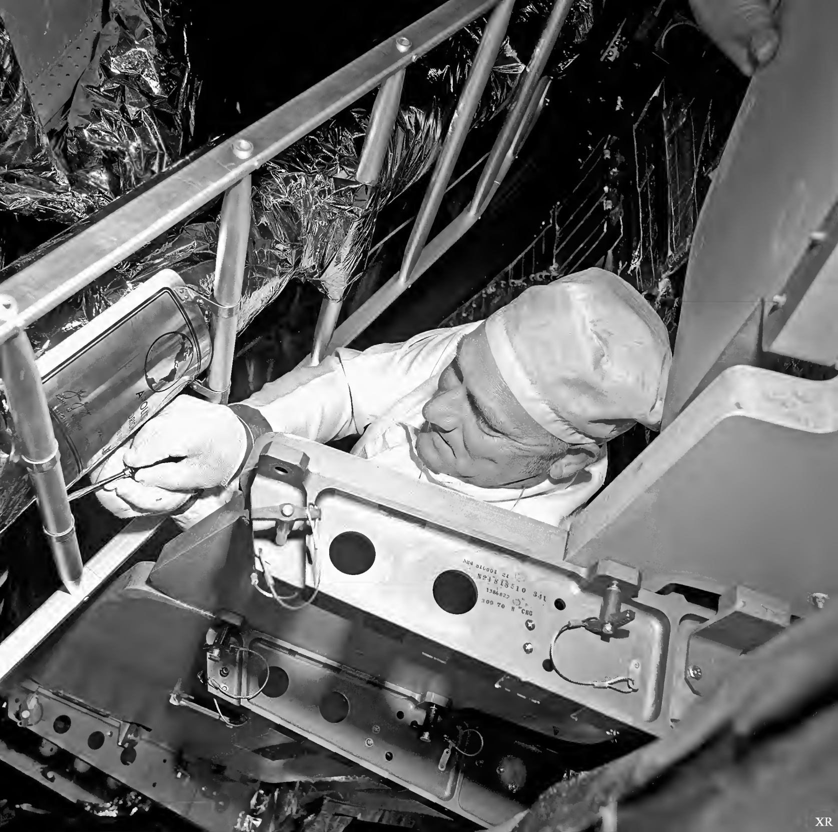
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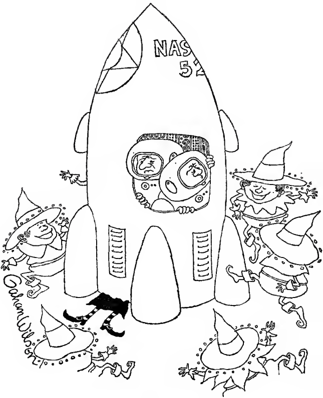

"Ding dong the witch is dead!"

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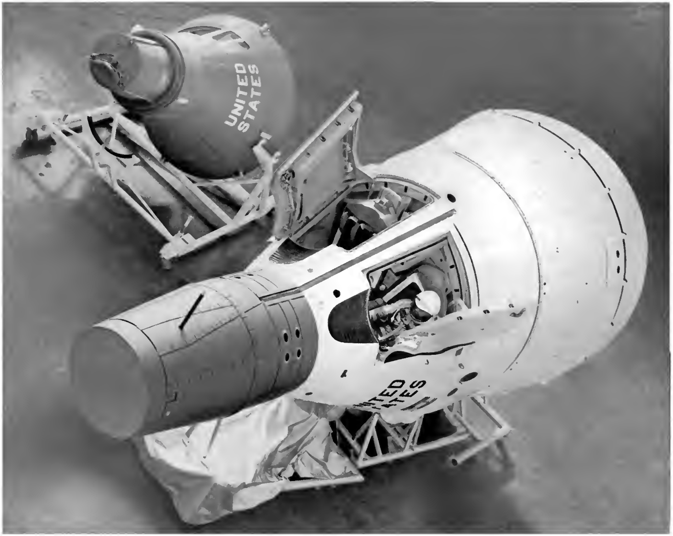
The Gemini mission—what it will be like . . .

Inside Our First Two-Man Spacecraft



◀**Gemini capsule** is shown compared with Mercury at McDonnell Aircraft, St. Louis. Gemini is more sophisticated, weighs about twice as much (7,000 pounds).

Getting ready: Scheduled to be first Gemini astronauts, pilot Gus Grissom (foreground) and copilot John W. Young try out their cockpit, which is much roomier than the Mercury capsule.

Not just a scaled-up Mercury capsule, the Gemini spacecraft is a ship for astronauts to fly

By Wesley S. Griswold

WITHIN the next few months, for the first time in our space program, two U.S. astronauts are expected to go into orbit together.

Their vehicle, the Gemini spacecraft, is far more than just a Mercury built for two. Besides being half again as roomy and twice as heavy as Mercury was, it is much more complex and efficient. That is because it will have many intricate tasks to perform before it completes its 12 scheduled missions.

Those missions will include flights lasting as long as two weeks. They will include practice rendezvous with another spacecraft in orbit (an Agena D rocket will play the supporting role). After rendezvous, Gemini will try space-docking, by sliding its nose into a socket in one end of the Agena D. In addition, Gemini's two astronauts will depressurize

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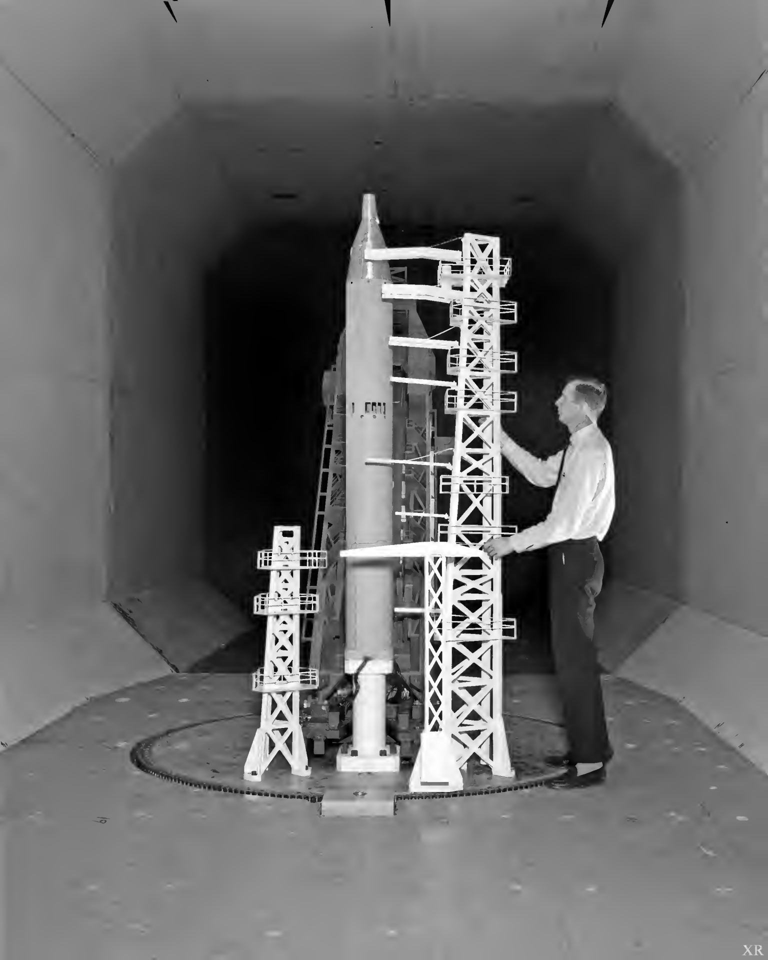

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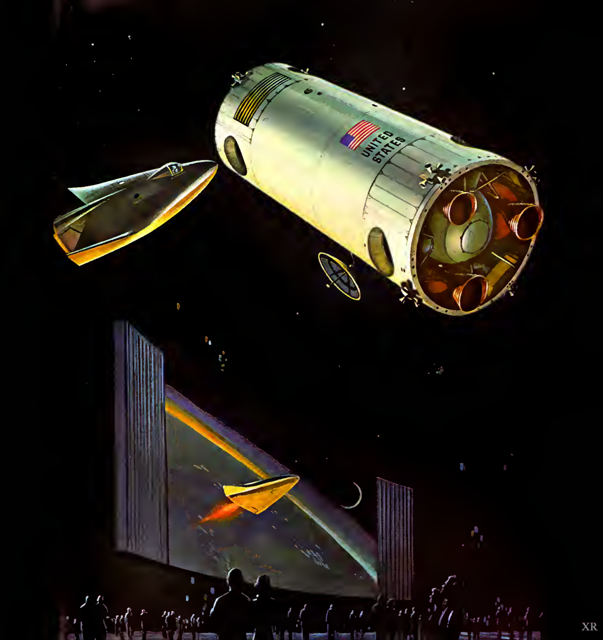
FLIGHT RESEARCH
CENTER
AD INEXPLORATA
0008
U.S. AIR FORCE
NASA



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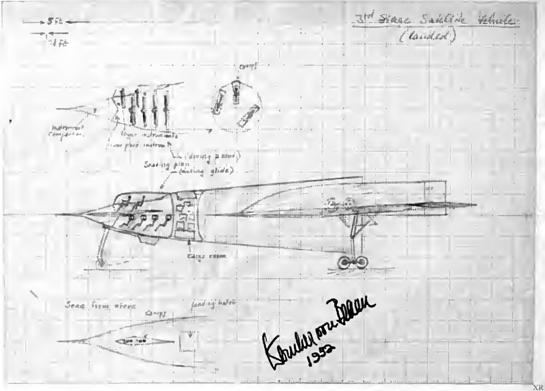

Wernher von Braun
1952

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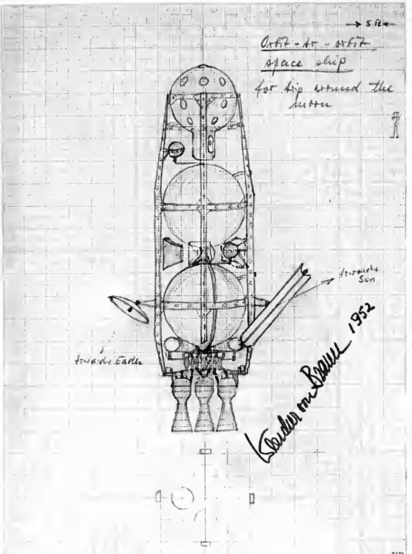
→ 5 ft ←
Orbit-to-orbit space ship
for trip around the moon
towards Sun
towards Earth
Wernher von Braun 1952

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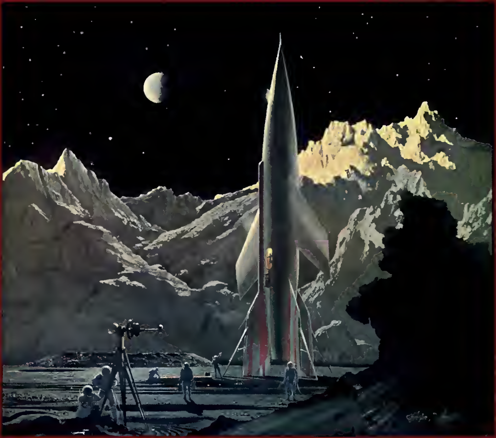
THE CONQUEST OF SPACE



A PREVIEW OF THE GREATEST ADVENTURE AWAITING MANKIND
WITH TEXT AND PICTURES BASED ON THE LATEST SCIENTIFIC RESEARCH

PAINTINGS BY
CHESLEY BONESTELL

TEXT BY
WILLY LEY

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ОТЧИЗНА! ПРОГРЕССА И МИРА ЗВЕЗДУ
ТЫ ПЕРВОЙ ЗАЖГЛА НАД ЗЕМЛЕЮ.
СЛАВА НАУКЕ, СЛАВА ТРУДУ!
СЛАВА СОВЕТСКОМУ СТРОЮ!

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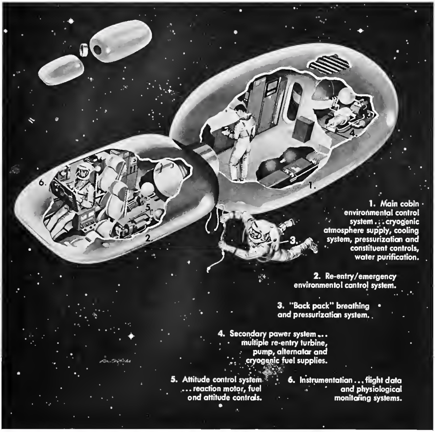

1. Main cabin environmental control system . . . cryogenic atmosphere supply, cooling system, pressurization and constituent controls, water purification.

2. Re-entry/emergency environmental control system.

3. "Back pack" breathing and pressurization system.

4. Secondary power system . . . multiple re-entry turbine, pump, alternator and cryogenic fuel supplies.

5. Attitude control system . . . reaction motor, fuel and attitude controls.

6. Instrumentation . . . flight data and physiological monitoring systems.

Manned space flight requires reliable and efficient thermal and atmospheric systems plus secondary power equipment. Complete, integrated systems (such as those pictured above) are under study at Garrett's AiResearch Manufacturing Divisions. Their design reflects 20 years of leadership in airborne and space systems, including NASA's Project Mercury life support system.

Other project areas at Garrett include: solar and nuclear power systems for space applications; electronic systems, including centralized flight data computer systems; and small gas turbines for both military and industrial use.

An orientation program lasting several months in diversified areas is available to every newly-graduated engineer to aid in his placement. It includes working on assignment with experienced engineers in laboratory, preliminary design and development projects.

For further information about a career with The Garrett Corporation, write to Mr. G. D. Bradley in Los Angeles.

GARRETT

THE GARRETT CORPORATION • AiResearch Manufacturing Divisions • Los Angeles 45, California • Phoenix, Arizona • other divisions and subsidiaries: Airsupply-Aero Engineering AiResearch Aviation Service • Garrett Supply • Air Cruisers • AiResearch Industrial • Garrett Manufacturing Limited • Marwedel • Garrett International S.A. • Garrett (Japan) Limited

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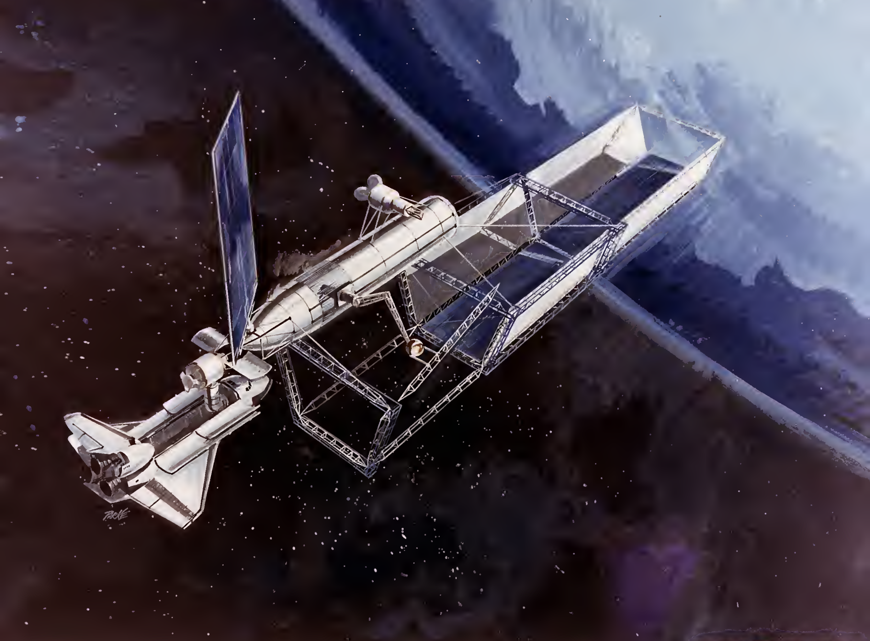
POWER MODULE CONSTRUCTION



MSFC-77-SB 4250

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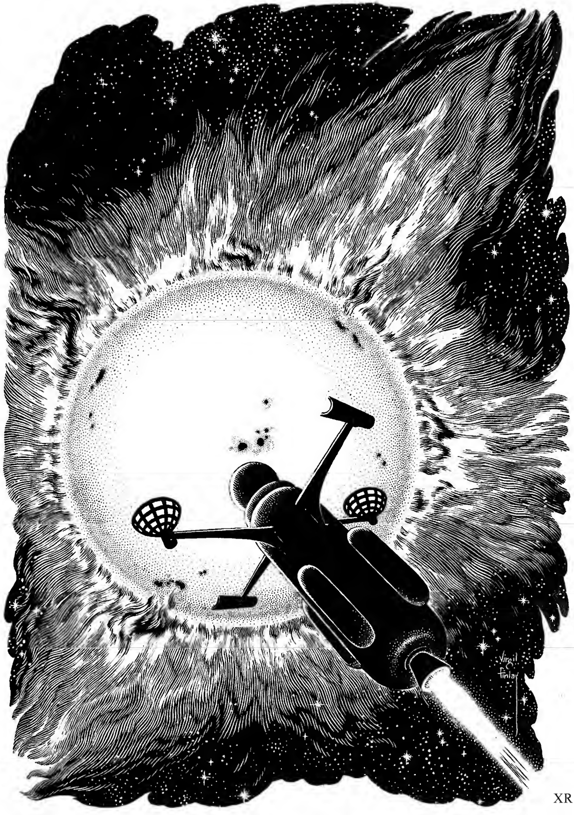
How Scientists Visualize
The REAL Flying Saucer Men

When scholars of the universe recreate spacemen along logical scientific lines, even those supposed weird little saucerites seem ordinary by comparison.

By I. B. Neer

PRYING eyes of science are probing into space again in the hope of detecting life on other planets.

Armed with new facts, previously accepted theories about what lies beyond the Earth are being discarded by scientists every day and the possibility grows more and more distinct that creatures, more fantastic than our most vivid imaginations could conjure up, may inhabit the planets around us. They



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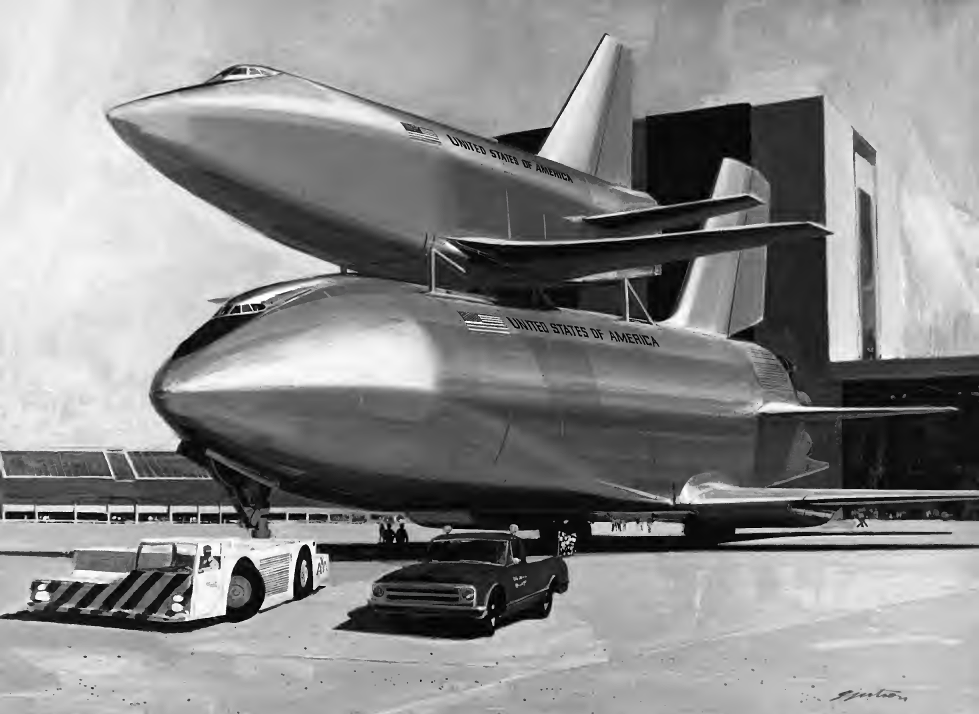

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Astronaut descending from his spaceship onto the surface of the Moon XR

PROJECT SPARC (SPACE RESEARCH CAPSULE)

Northeast High School in Philadelphia teaches aerospace science. Simulated flights are regularly scheduled and astronauts are chosen on the basis of physical and mental ability.

The last flight took place on March 19, 1968. The test lasted eight days and was the most detailed yet.

Capsule Sealed

The three astronauts lived in an oxygen replenishment loop. That is, the Apollo capsule was sealed and the same air was continuously recycled in and out of the capsule. Oxygen was added and carbon dioxide removed. Humidity and temperature were regulated.

—Project SPARC, Northeast High School

Student astronauts prepare to enter their Apollo capsule for an eight-day trip.

The astronauts wore wires so that heartbeat, respiration, pulse, body temperature, and blood pressure could be periodically checked. The checking was done by students under the direction of physicians.

129 Orbits

During the simulated flight, the craft made 129 orbits around the Earth, following a strict flight plan that placed each maneuver in a particular time slot.

The class is looking forward to obtaining a new Apollo capsule now under construction. The new simulator will have all the equipment found in a real Apollo capsule.

In the dim future a powerful spaceship may succeed in landing on the weird surface of Jupiter.

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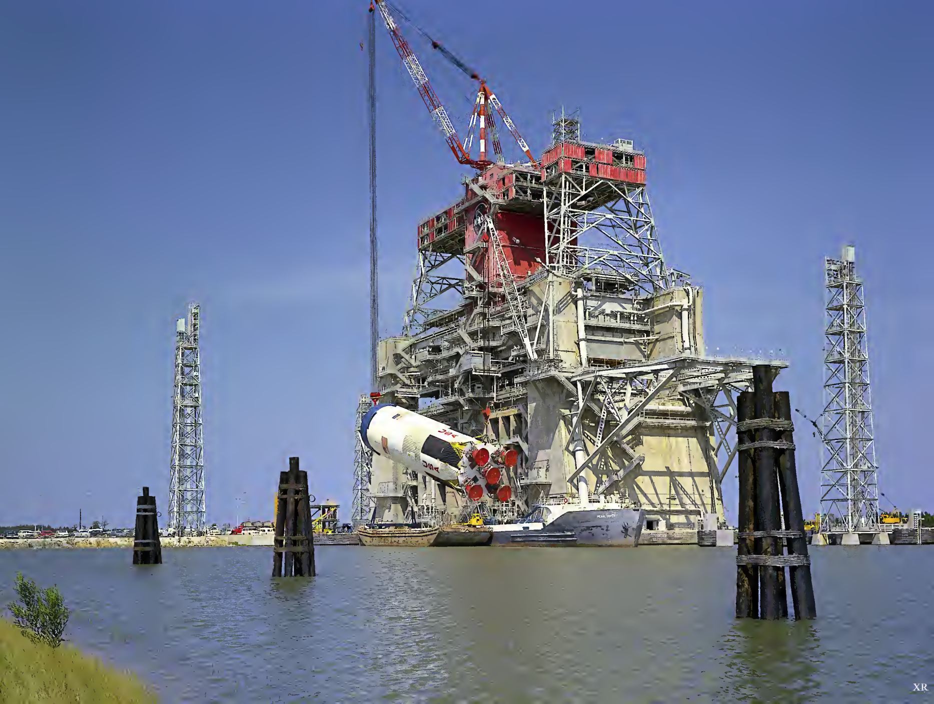

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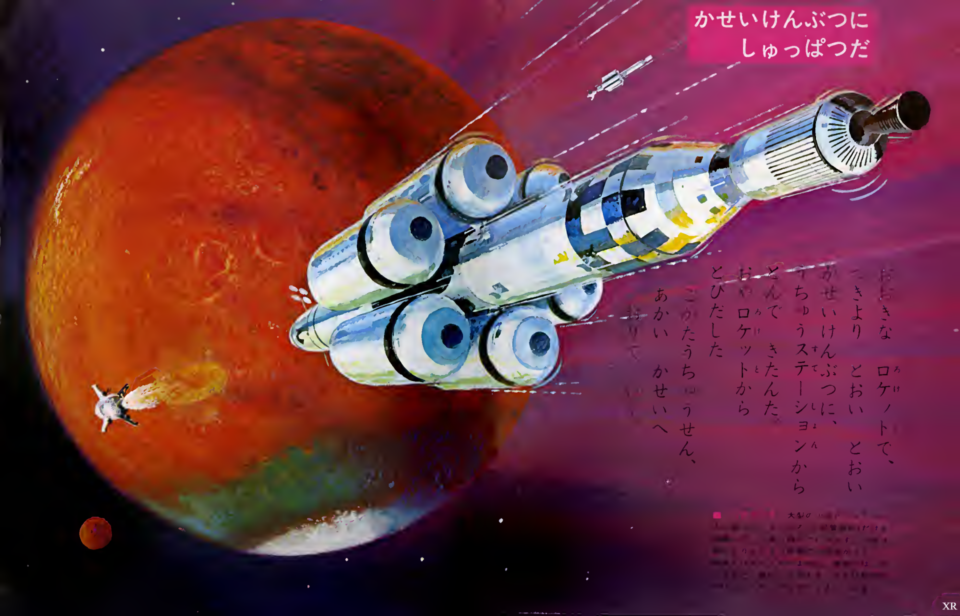
かせいけんぶつに しゅっぱつだ



おおきな　ロケットで、
つきより　とおい　とおい
かせいけんぶつに、
うちゅうステーションから
とんで　きたんだ。
おや　ロケットから
とびだした
こがたうちゅうせん、
あかい　かせいへ
おりて　いく

■ [illegible] 大型の [illegible]

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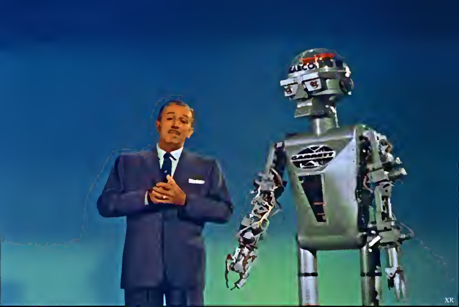
F.BORMAN
NASA



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SIDEREVS
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GALILEO GALILEO
MEDICEA SIDERA

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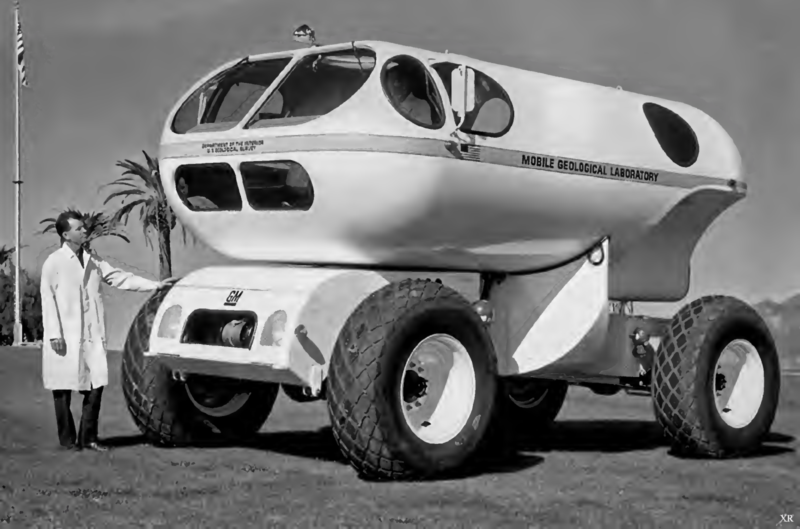

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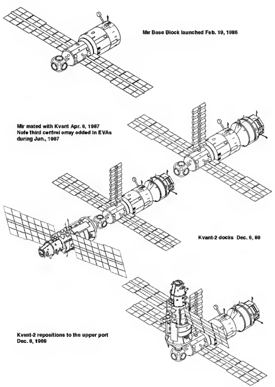
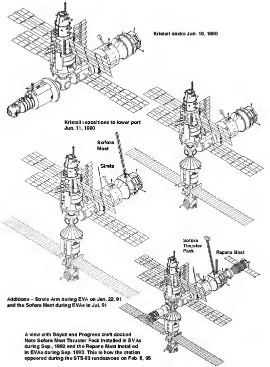


Mir Base Block launched Feb. 19, 1986

Mir mated with Kvant Apr. 9, 1987
Note third central array added in EVAs
during Jun., 1987

Kvant-2 docks Dec. 6, 89

Kvant-2 repositions to the upper port
Dec. 9, 1989

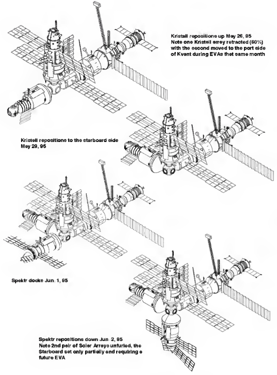


Kristall docks Jun. 10, 1990

Kristall repositions to lower port
Jun. 11, 1990

Additions – Strela Arm during EVA on Jan. 22, 91
and the Sofora Mast during EVAs in Jul. 91

A view with Soyuz and Progress craft docked
Note Sofora Mast Thruster Pack installed in EVAs
during Sep., 1992 and the Rapana Mast installed
in EVAs during Sep. 1993. This is how the station
appeared during the STS-63 rendezvous on Feb. 6, 95

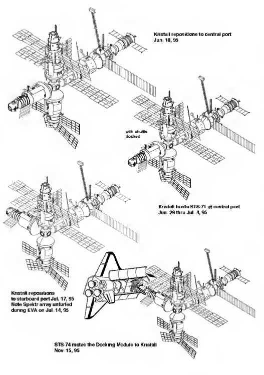


Kristall repositions up May 26, 95
Note one Kristall array retracted (60%)
with the second moved to the port side
of Kvant during EVAs that same month

Kristall repositions to the starboard side
May 29, 95

Spektr docks Jun. 1, 95

Spektr repositions down Jun. 2, 95
Note 2nd pair of Solar Arrays unfurled, the
Starboard set only partially and requiring a
future EVA

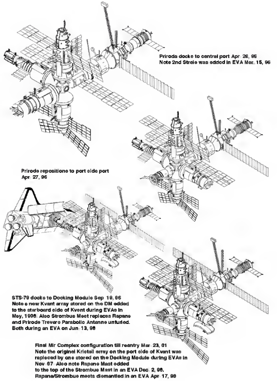


Kristall repositions to central port
Jun. 10, 95

Kristall hosts STS-71 at central port
Jun. 29 thru Jul. 4, 95

Kristall repositions
to starboard port Jul. 17, 95
Note Spektr array unfurled
during EVA on Jul. 14, 95

STS-74 mates the Docking Module to Kristall
Nov. 15, 95



Priroda docks to central port Apr. 26, 96
Note 2nd Strela was added in EVA Mar. 15, 96

Priroda repositions to port side port
Apr. 27, 96

STS-79 docks to Docking Module Sep. 19, 96
Note a new Kvant array stored on the DM added
to the starboard side of Kvant during EVAs in
May, 1996. Also Strombus Mast replaces Rapana
and Priroda Travers Parabolic Antenna unfurled.
Both during an EVA on Jun. 13, 96

Final Mir Complex configuration till reentry Mar. 23, 01
Note the original Kristall array on the port side of Kvant was
replaced by one stored on the Docking Module during EVAs in
Nov. 97. Also note Rapana Mast added
to the top of the Strombus Mast in an EVA Dec. 2, 98.
Rapana/Strombus masts dismantled in an EVA Apr. 17, 98

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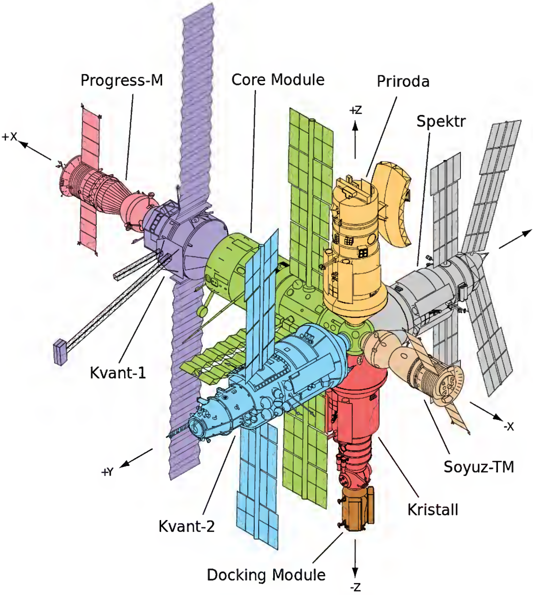
Progress-M
Core Module
Priroda
+Z
Spektr
+X
-Y
Kvant-1
-X
Soyuz-TM
+Y
Kristall
Kvant-2
Docking Module
-Z

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Почта
всех времен
и народов
Из истории
отечественной
почты
СССР
ПОЧТА СССР
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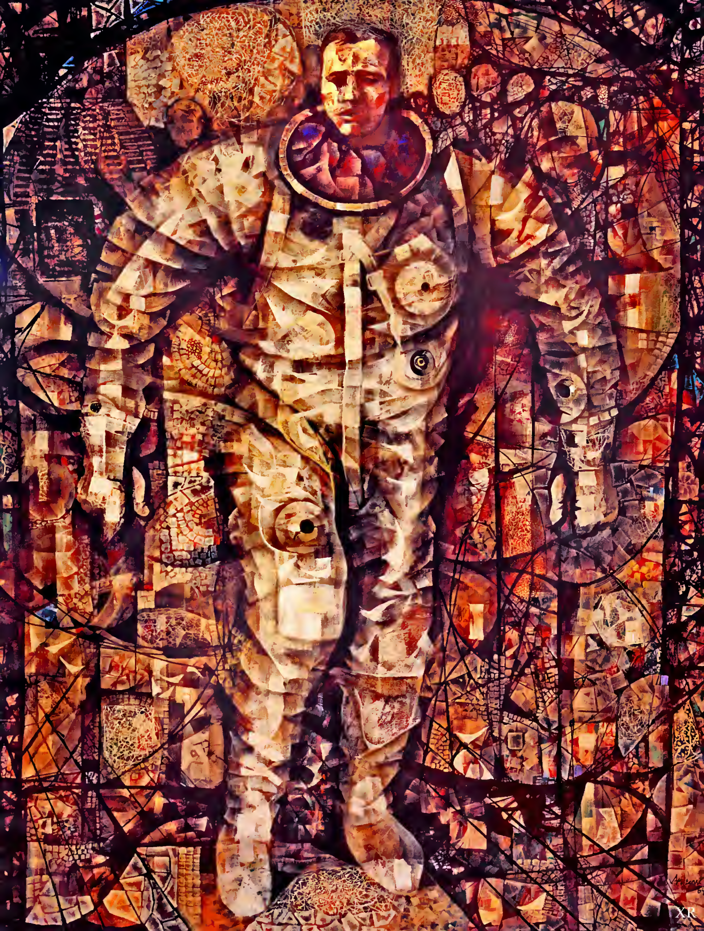

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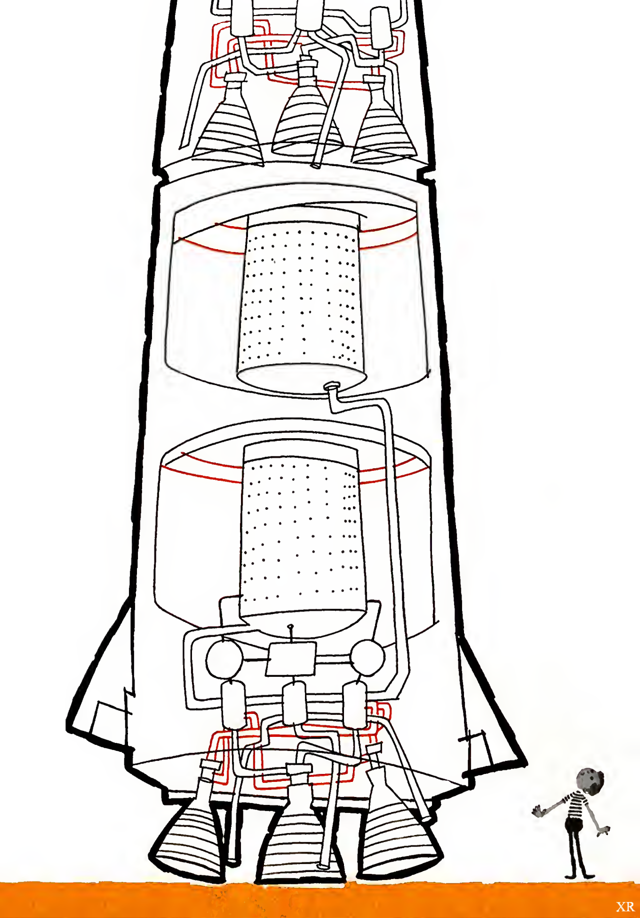
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LA DOMENICA DEL CORRIERE

Supplemento settimanale illustrato del nuovo CORRIERE DELLA SERA - Abbonamenti: Italia, anno L. 1870, semestre L. 1000 - Estero, anno L. 3430, semestre L. 1780

Anno 60 — N. 3 19 Gennaio 1958 L. 40.—

Un uomo a 300.000 metri? *Da voci raccolte a Mosca i russi, ai primi dell'anno, avrebbero lanciato nella ionosfera un razzo avente a bordo un uomo. All'altezza di trecento chilometri, la capsula pressurizzata che faceva da abitacolo al passeggero sarebbe stata catapultata fuori del missile e, trattenuta da paracadute, avrebbe iniziato la discesa verso la Terra, raggiunta felicemente. La notizia, partita da Mosca, non ha trovato, però, conferma negli ambienti ufficiali, per quanto l'impresa venga fatta apparire dai tecnici come perfettamente possibile.* (Disegno di Walter Molino)